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Vauclain, Samuel
Matthews

Locomotive development

Philadelphia

1923

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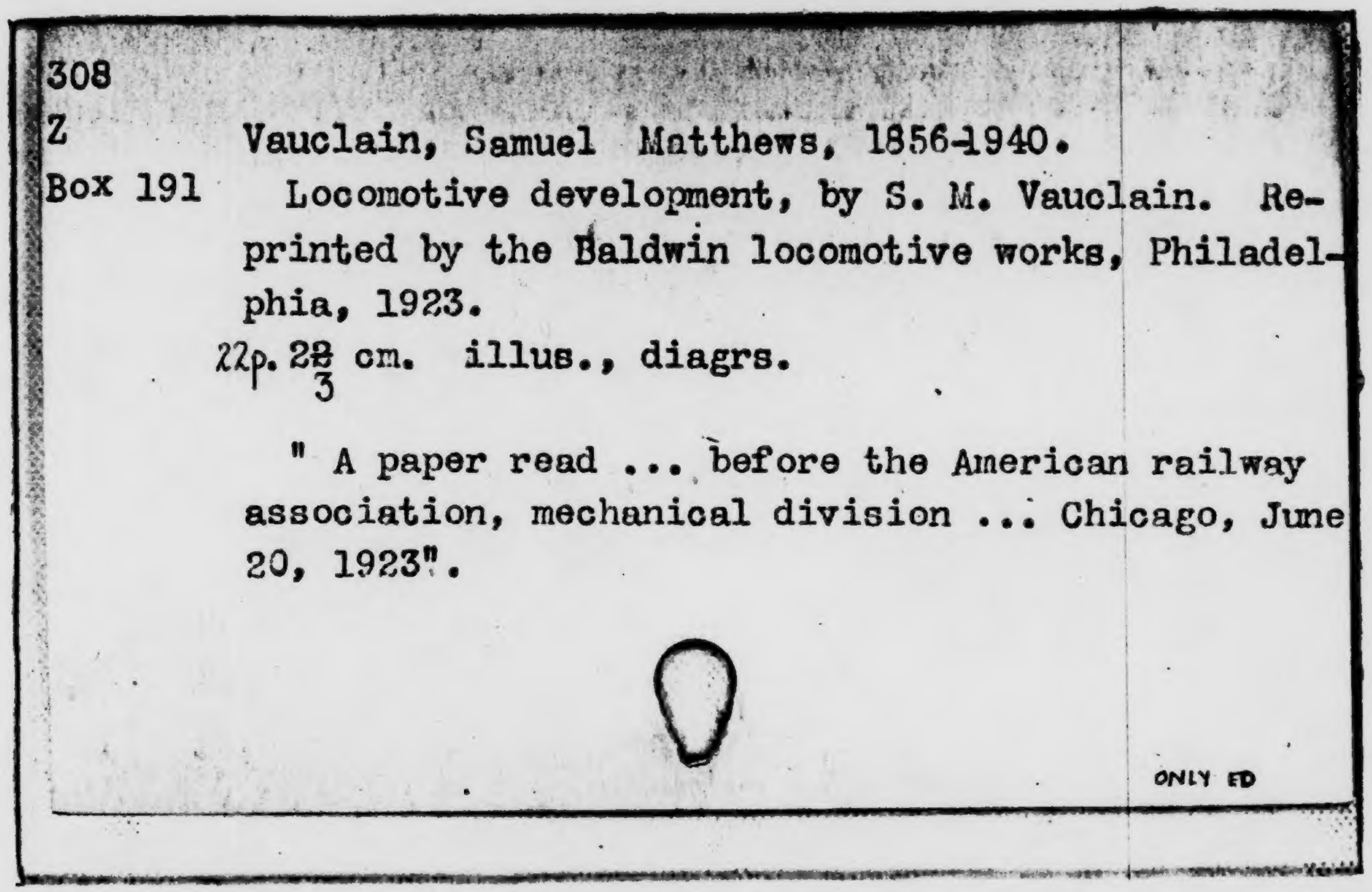

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Locomotive Development

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By

S. M. VAUCLAIN

Reprinted by
The Baldwin Locomotive Works
Philadelphia, 1923

Mar. 20, 1926 J.L.S.
Ac—

Locomotive Development

A paper read by

S. M. VAUCLAIN

President, The Baldwin Locomotive Works

before the

American Railway Association

MECHANICAL DIVISION

Master Car Builders Master Mechanics

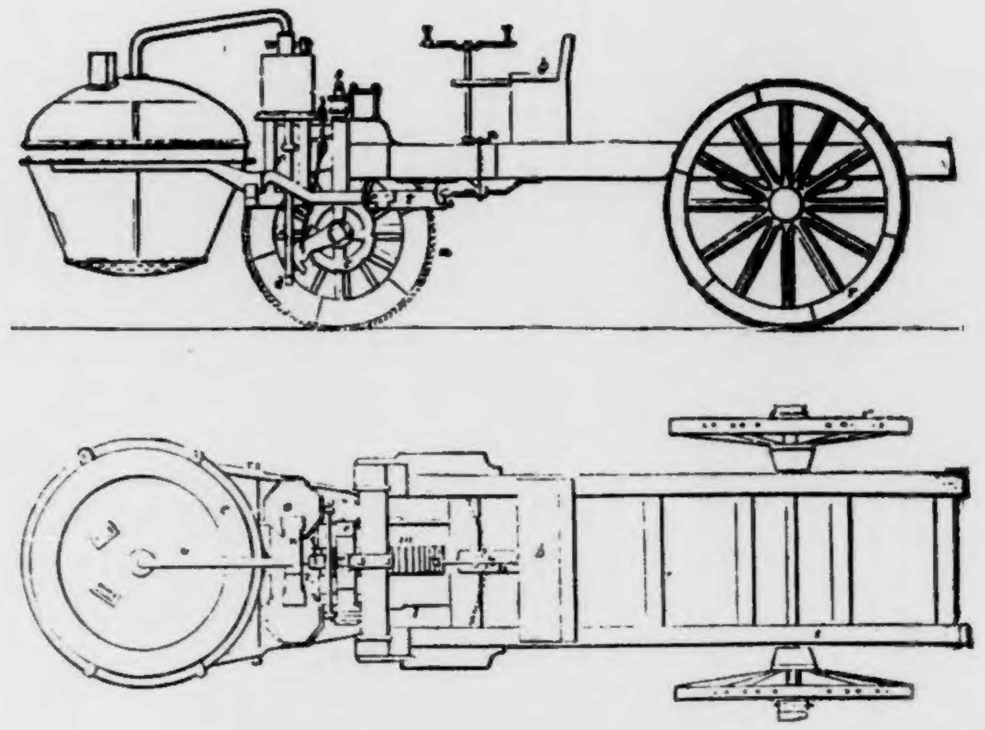
Chicago, June 20, 1923.

GENTLEMEN OF THE AMERICAN RAILWAY ASSOCIATION, MECHANICAL DIVISION:—

I have been invited to deliver an address on the "Development of the Locomotive, the Necessity for Its Development and the Improvements Necessary to Assist in the Transportation Problems of this Country."

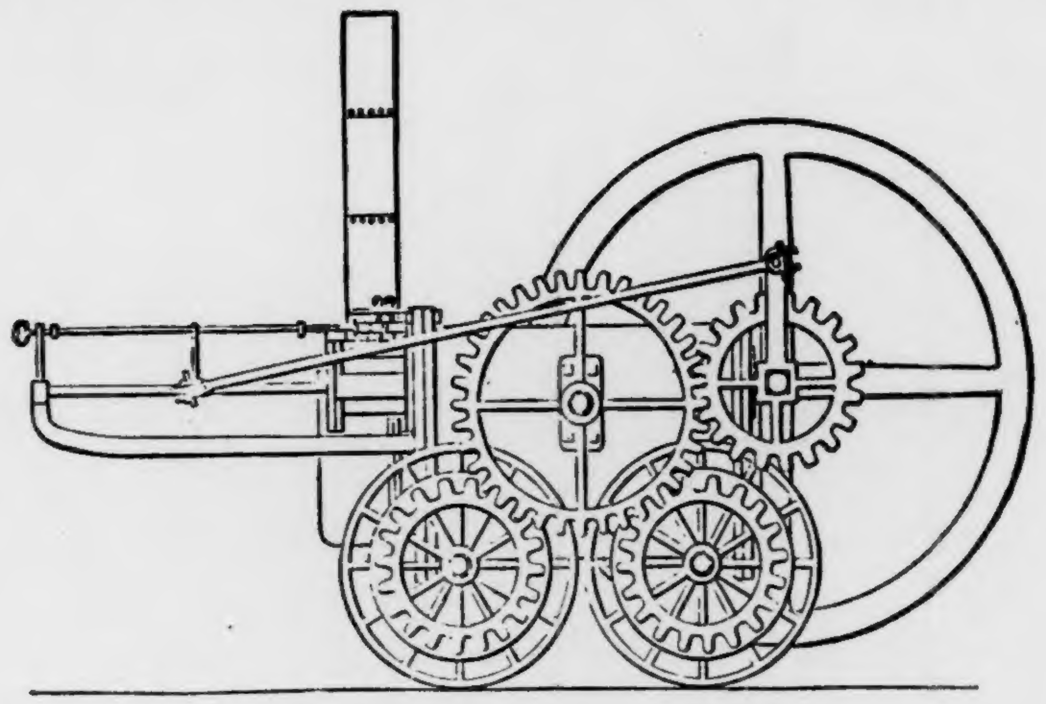
This is quite a large subject to be disposed of in a very short space of time, and I know that most of those present are thoroughly familiar with the history of the locomotive and the necessities which led to its conception, as well as some of the difficulties that were surmounted in its introduction as a public servant. This it has continued to be for more than one hundred years with an ever-increasing intensity in its devotion to the business world.

Transportation, however, has been and always will be a governing factor of prosperity. Those countries favored with superior transportation facilities will, other things being equal, prosper to a much greater extent than those where such facilities are more or less limited. Railway transportation has made the United States what it is today. Practically all other forms of transportation have been superseded, and many of the water systems of transportation formerly in use have been abandoned. Quantity and quality are the constant cry and can only be met by superior equipment which the science of railway engineering has made possible for the great railway systems of our country to employ.

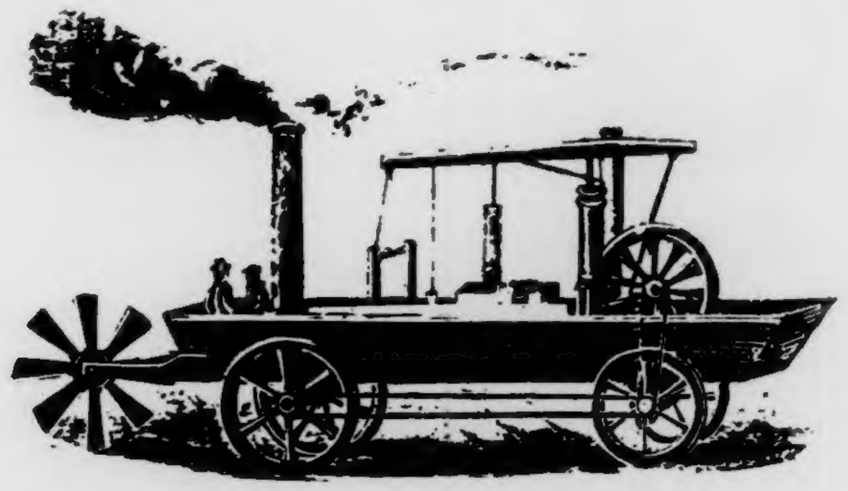


Cugnot's Steam Carriage, 1771

As far as is known, the first vehicle to be actually propelled by steam was a gun carriage built by Nicholas Cugnot, in Paris in 1771, while the first locomotive designed to run upon rails was built in 1803 by Richard Trevithick, a name that is still associated with the locomotive industry in England; a name that has received distinction as well in other countries, principally Egypt and Japan.



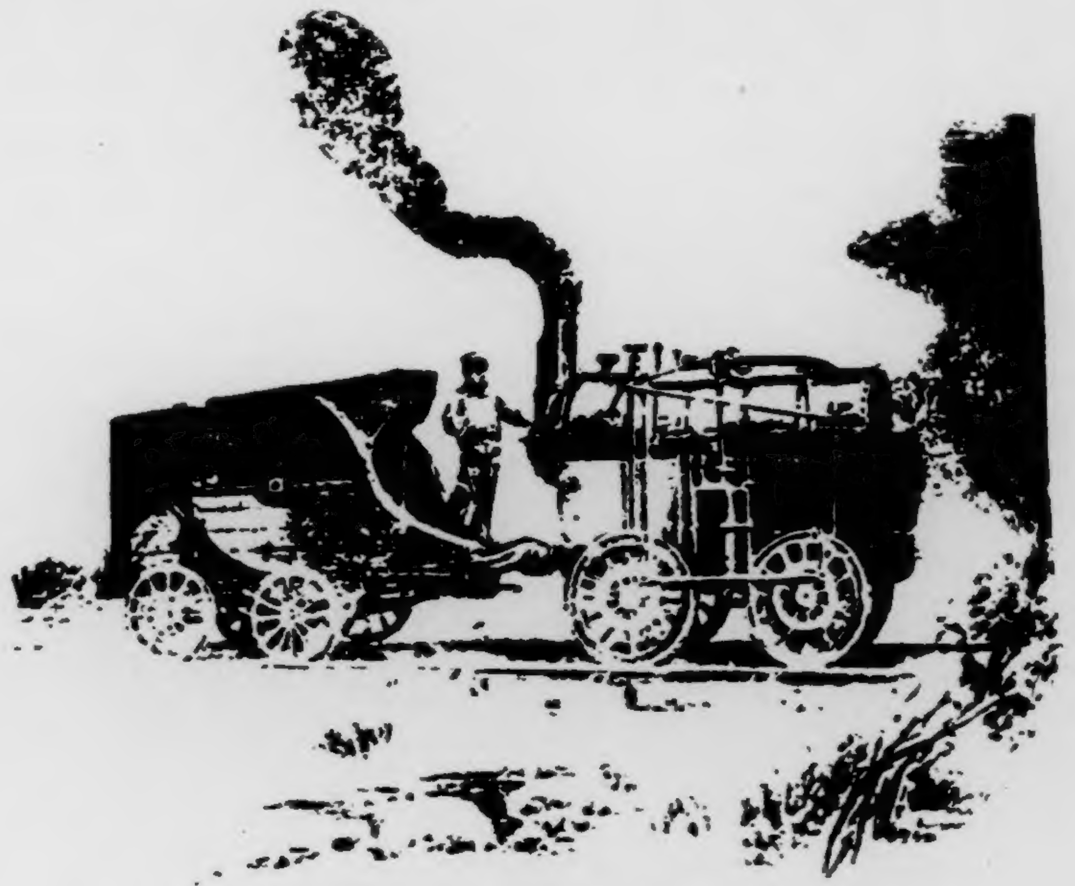
Trevithick's Locomotive, 1803



Evans' "Oructor Amphibolis," 1804

Strange to say, the first successful effort in locomotion by steam in America was the "Oructor Amphibolis," constructed by Oliver Evans in the City of Philadelphia in 1804. Mr. Evans' shops occupied the ground on which the United States Mint now stands; a site now surrounded by the buildings of the present Baldwin Locomotive Works, operating night and day, continuing the industry originated by Evans on this very spot. This locomotive was really a dredging scow designed to run on land or water, but principally to navigate the rivers between which Philadelphia lies. In order to get it from the factory to the river it became necessary to use it as a locomotive that would operate on the streets and without rails to guide it. Its performance was successful, but its utility questionable. Even at that time Mr. Evans realized the advantage of using a high steam pressure and expanding it in the cylinder so as to obtain some greater economy in its use.

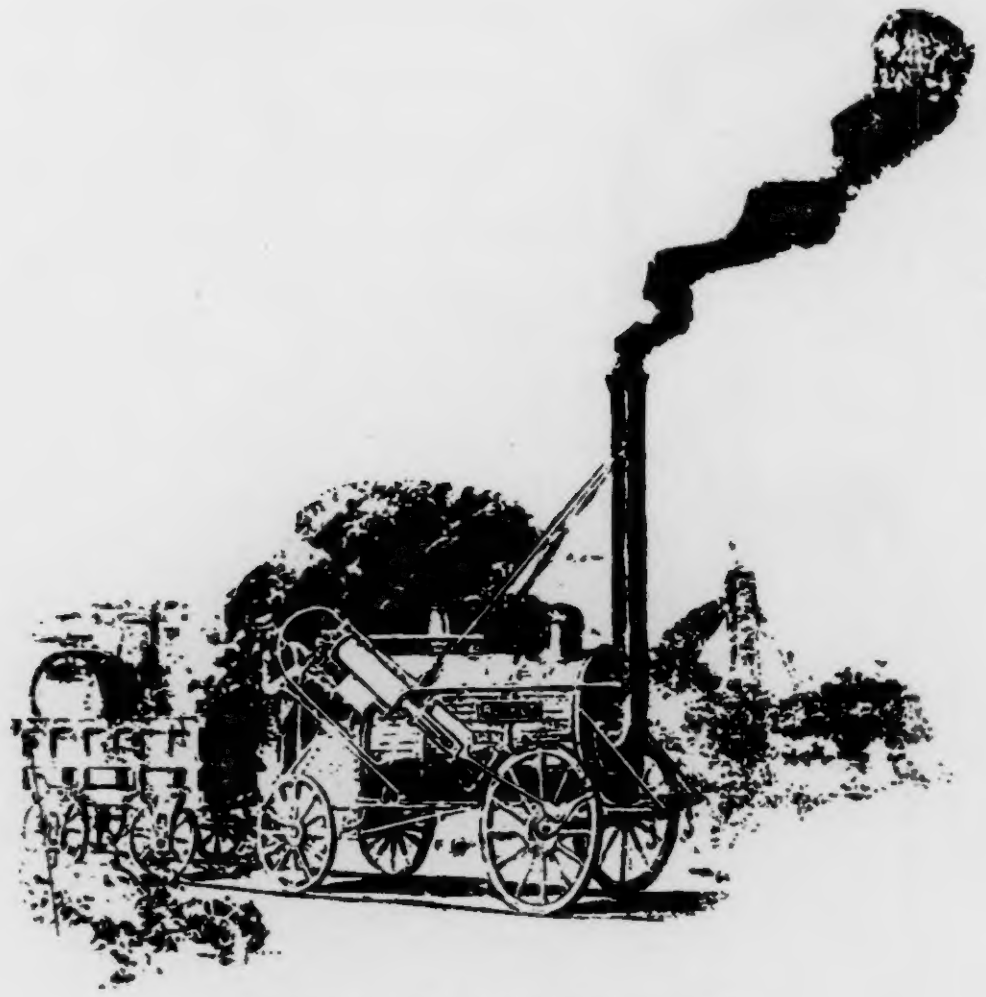
It would be useless to attempt to trace the development of the locomotive in foreign lands, as a more complete understanding can be had in this short time by reviewing briefly the progress made in the development in this country, of this very wonderful power house for locomotion.



Seguin's Locomotive, 1827

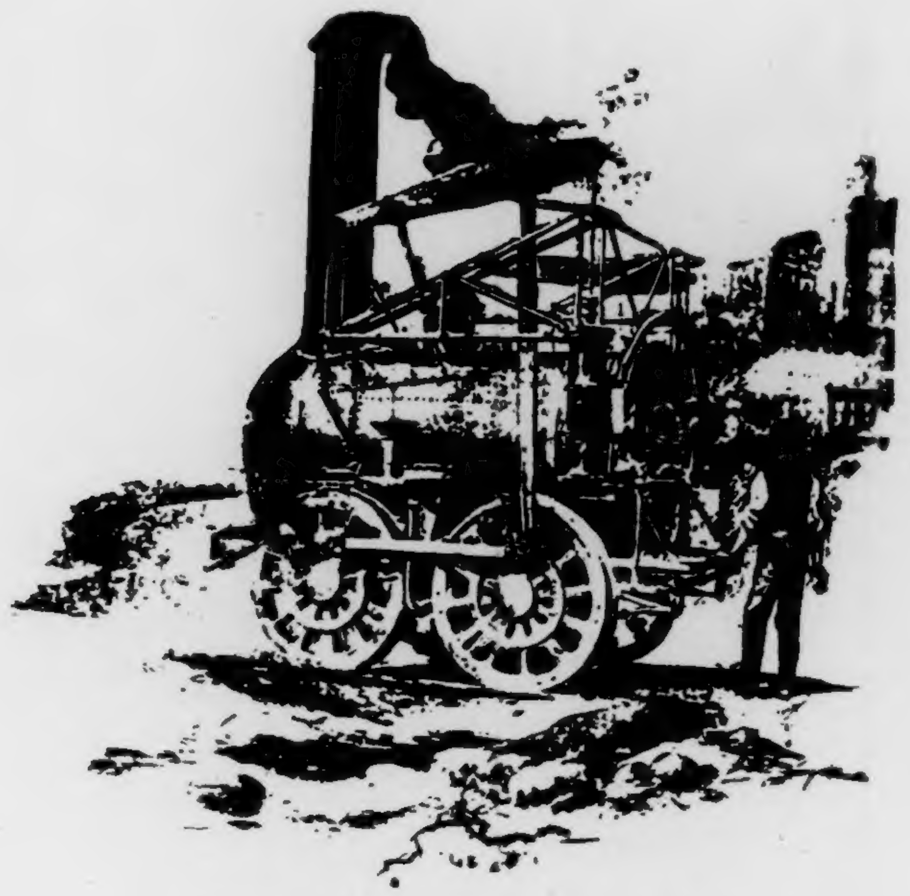
Mention should be made, however, of the first locomotive with a horizontal multitubular boiler, built by Seguin in France in 1827; and also of the famous "Rocket," constructed in England by George Stephenson in 1829. This locomotive was awarded the prize in a contest on the Liverpool and Manchester Railway. It was the first locomotive to combine three basic features which are still universally employed, viz.; a horizontal multitubular boiler, pistons directly connected to the driving wheels, and the use of the exhaust steam, which was discharged up the stack, to furnish a draft for the fire, and thus make possible the generation of large quantities of steam in proportion to the size of the boiler and draft intensity.

The various experiments and attempts in this early period to apply steam locomotives to the uses of transportation in the United States were more or

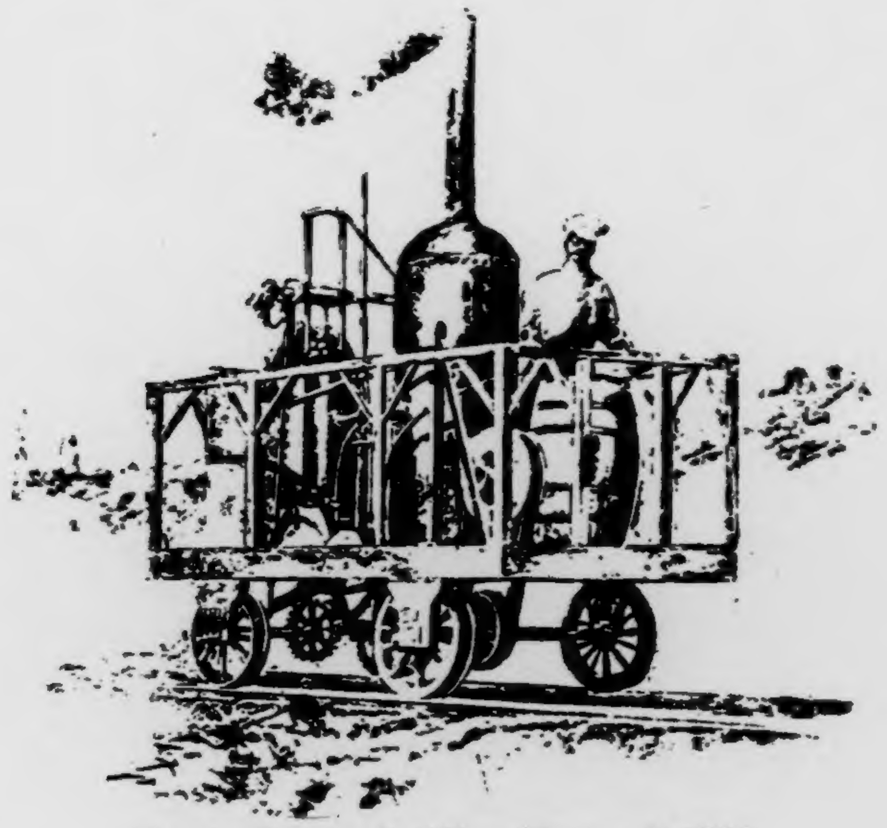


STEPHENSON'S "ROCKET," 1829

less successful. Those of foreign construction imported for the purpose gave results that were sufficiently satisfactory to interest the brightest engineering minds in the country and influence them to attempt the construction of American-built locomotives. The first locomotive to be used in the United States, however, was built in England and was named the "Stourbridge Lion." It made a few trips on the Delaware and Hudson Canal Company's road at Honesdale, Pa., in 1829, but was considered too heavy for the track and bridges, and was soon withdrawn from service.

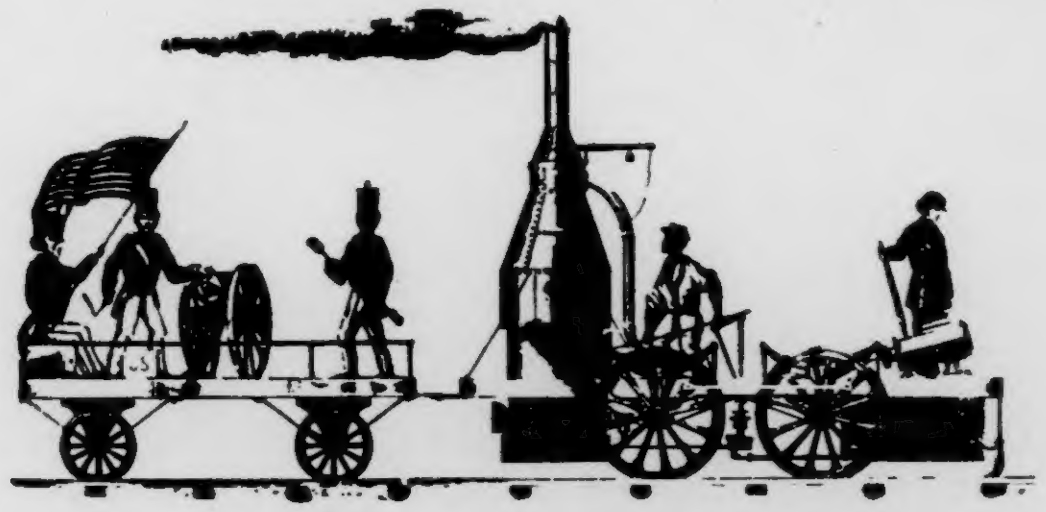


THE "STOURBRIDGE LION," 1829



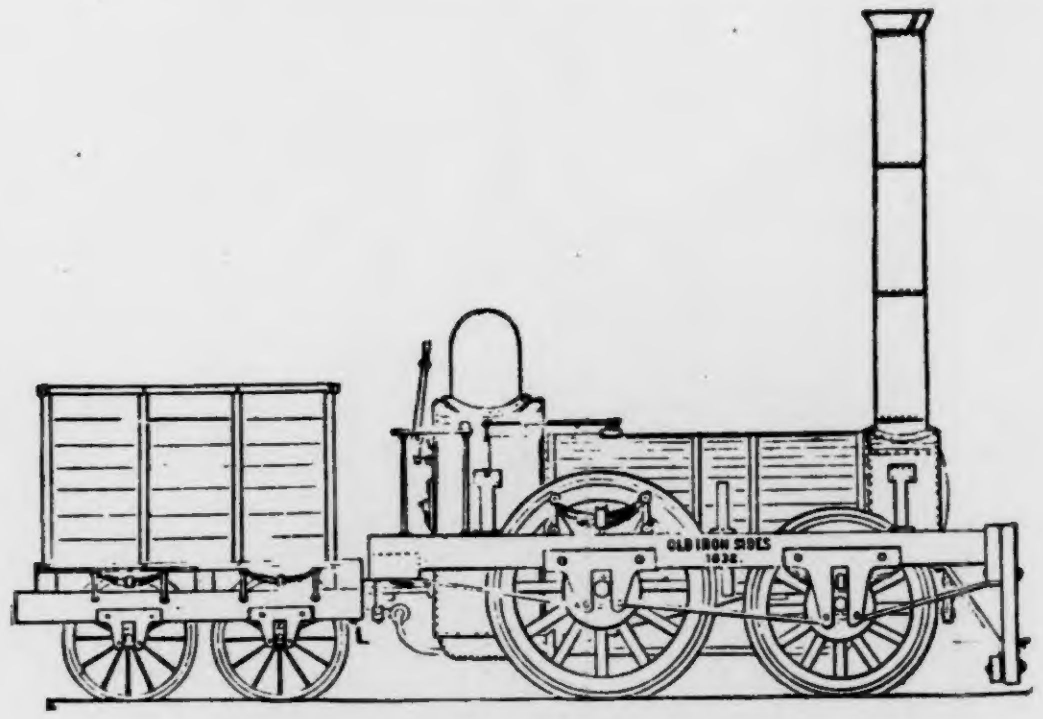
PETER COOPER'S "TOM THUMB," 1830

The first locomotive actually built in America was the "Tom Thumb," designed by Peter Cooper, a merchant of Baltimore, and used experimentally on the Baltimore and Ohio in 1830. It was about the size of a hand car, but it demonstrated the practicability of steam as a motive power. Then came the "Best Friend," the first locomotive built for commercial purposes in this country, constructed in 1830 at the West Point Foundry in New York for the South Carolina Railroad. This engine was very successful for about seven months, when its boiler unfortunately exploded, because the fireman became annoyed at the blowing-off of steam at the safety valve and weighted down the lever to ease his mind.



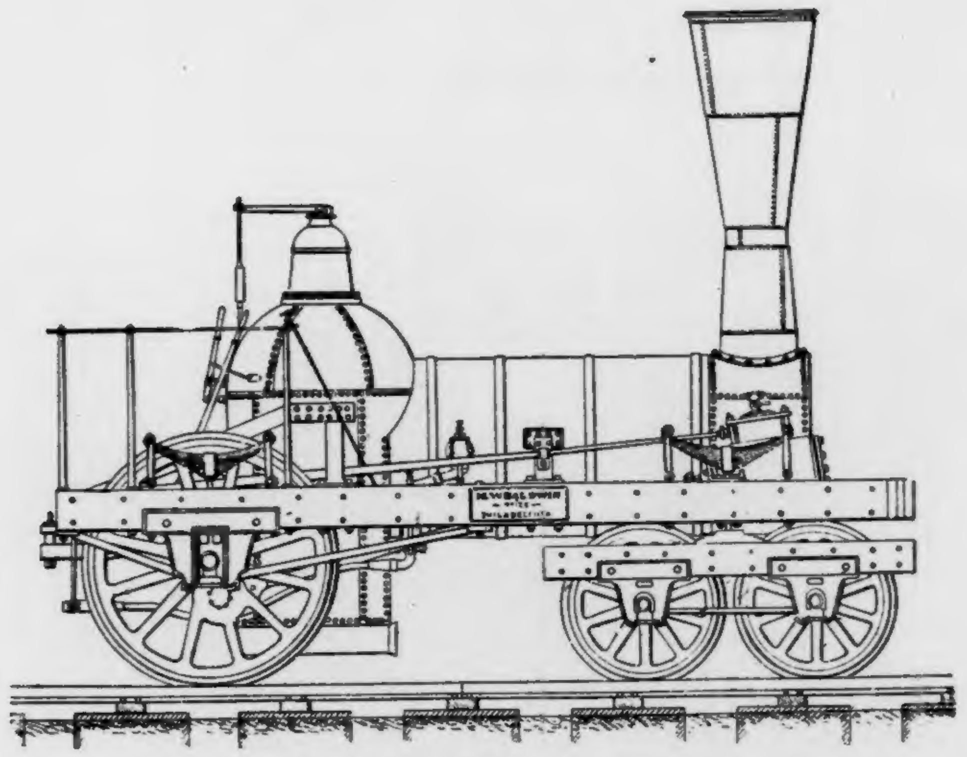
THE "BEST FRIEND," 1830

"Old Ironsides" was built by Matthias Baldwin and put in service in 1832 on the Philadelphia, Germantown & Norristown Railroad. Its weight was five tons. It was built under great difficulties. Its operation, all things considered, was very successful. It was quite a while before the officers of the Company would permit this locomotive to go out in the rain; on rainy days horses were used, but one day it was caught out on the rails when the rain descended, and proved its ability to operate under such discouraging circumstances. The American locomotive has been out in the rain ever



BALDWIN'S "OLD IRONSIDES," 1832

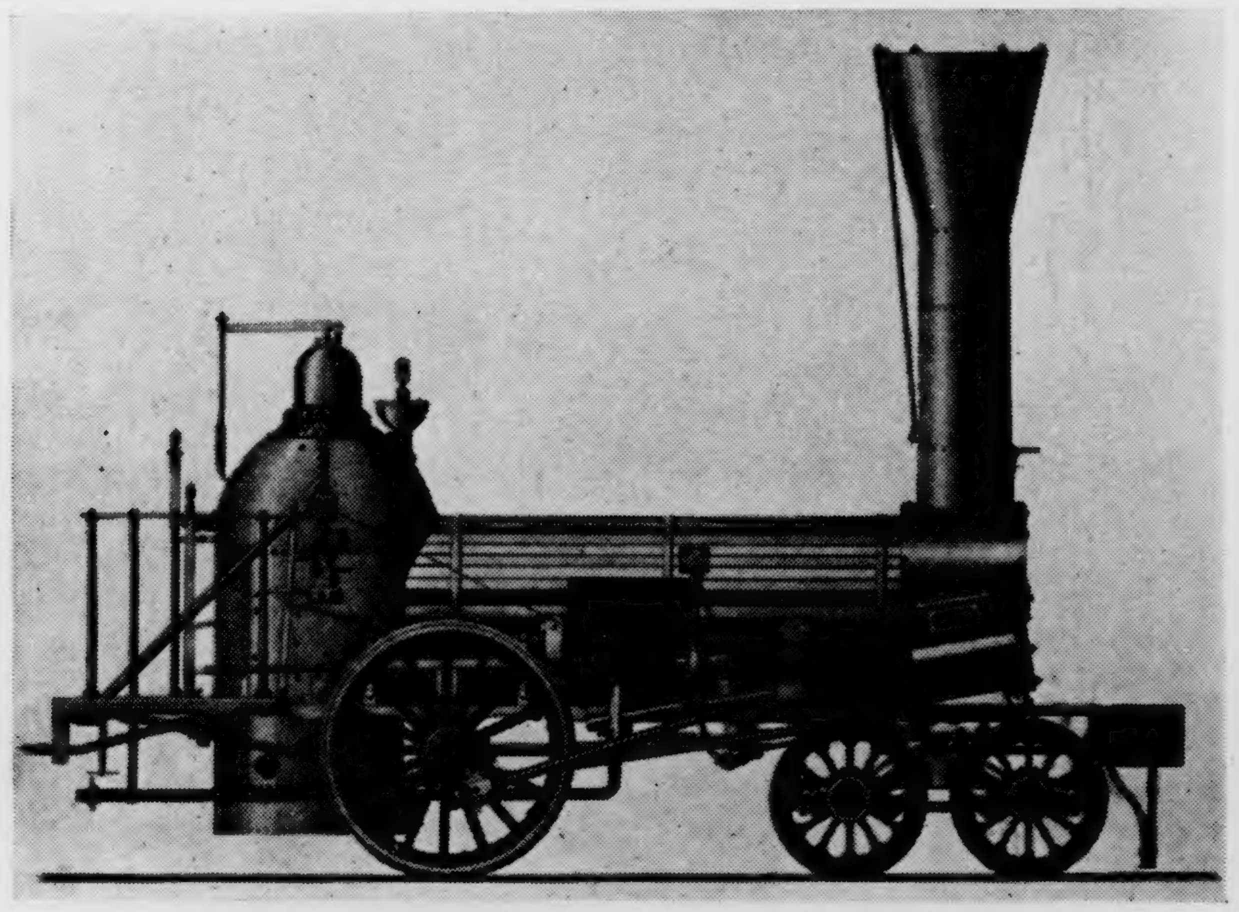
since. It will be noted that "Old Ironsides" had its driving wheels ahead of the firebox, with one large pair of carrying wheels supporting the front end of the engine. This added greatly to its adhesive qualities.



BALDWIN LOCOMOTIVE OF 1834

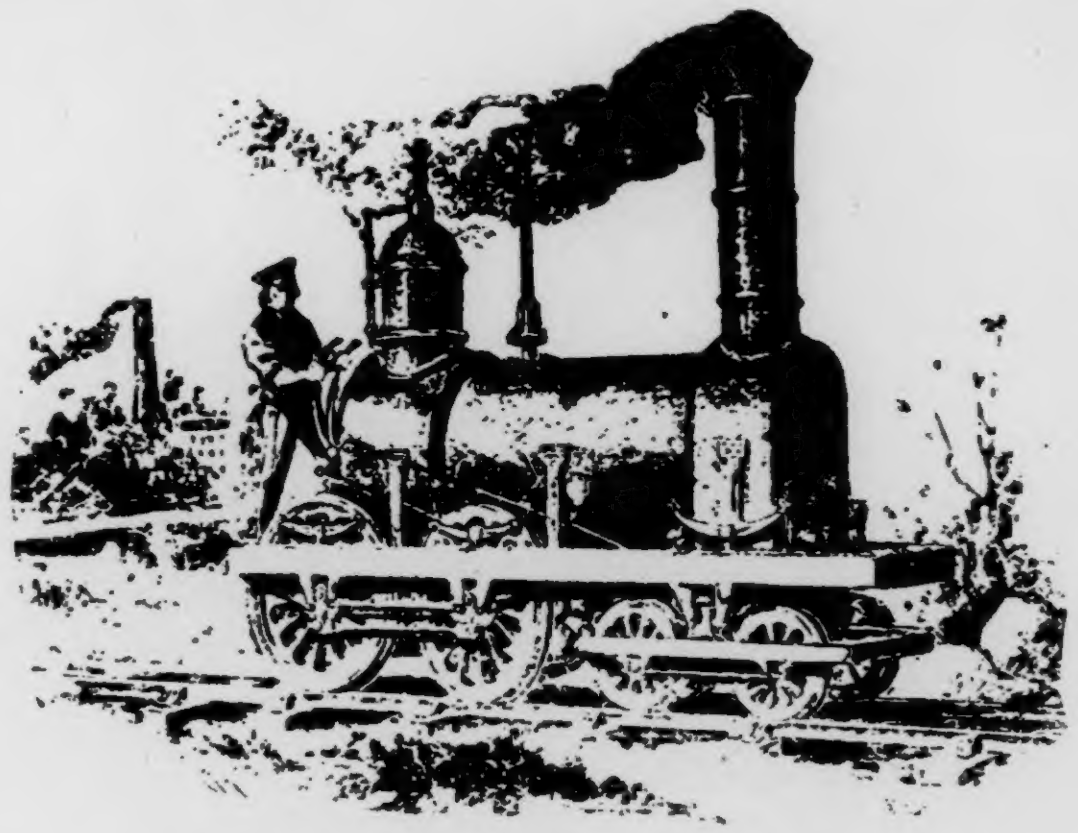
The further development of the locomotive by Mr. Baldwin led him to introduce a four-wheeled truck, and in this design the driving wheels were placed behind the firebox, which materially reduced the adhesion for traction purposes. The truck had first been used by John B. Jervis in 1831, and it provided the flexibility of wheel-base so essential to locomotives that operated on the sharp curves and uneven tracks of that period.

The engineers of that day seem to have realized the benefit to be derived from high pressure steam, and when Mr. Baldwin introduced ground metallic joints in place of canvas and red lead joints for steam pipes, he opened the way for those who were to follow him in future and employ still higher steam pressure.



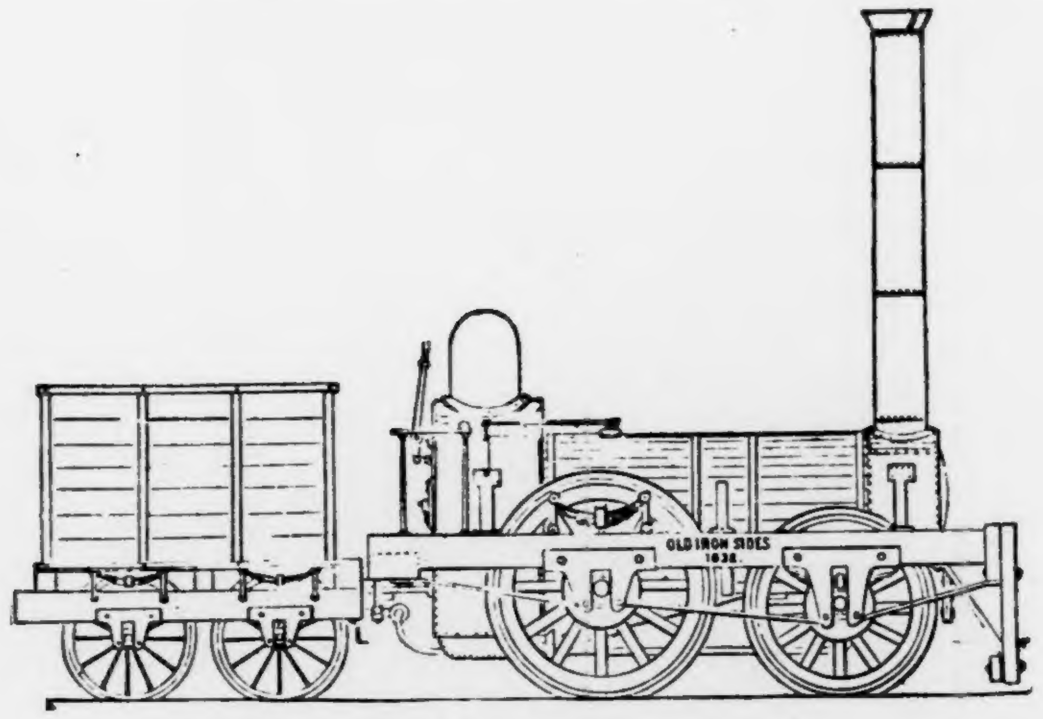
EARLY NORRIS LOCOMOTIVE

About this time the Norris Locomotive Works were established. Mr. Norris succeeded in building a locomotive of the same total weight as Mr. Baldwin's engine but of greater hauling power, by using a four-wheeled truck and placing the driving wheels in front of the firebox, so that a greater portion of the weight of the engine was utilized for traction. The next logical step in locomotive development in order to gain power was to use two pairs of driving wheels, placing one pair in front of the firebox and one behind it.



CAMPBELL'S EIGHT-WHEELED LOCOMOTIVE, 1836

This was done by Henry R. Campbell in 1836, who designed the first American (4–4–0) type locomotive, and had such a machine built by James Brooks of Philadelphia. This locomotive had no equalizing beams between the two pairs of driving wheels and, therefore, did not perform very satisfactorily.



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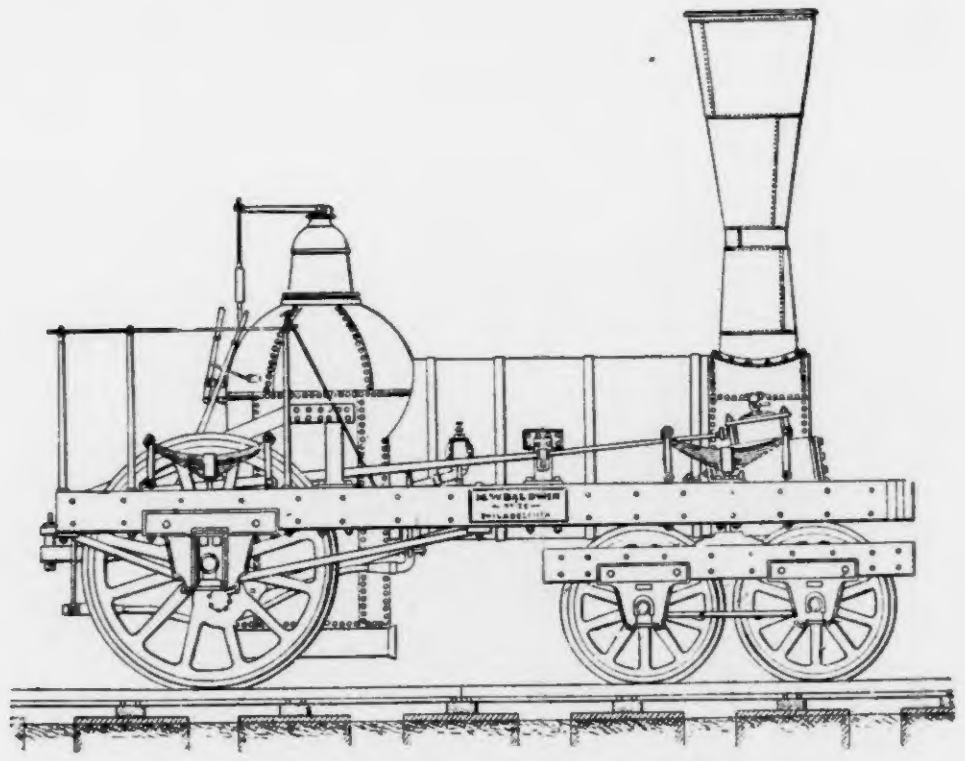

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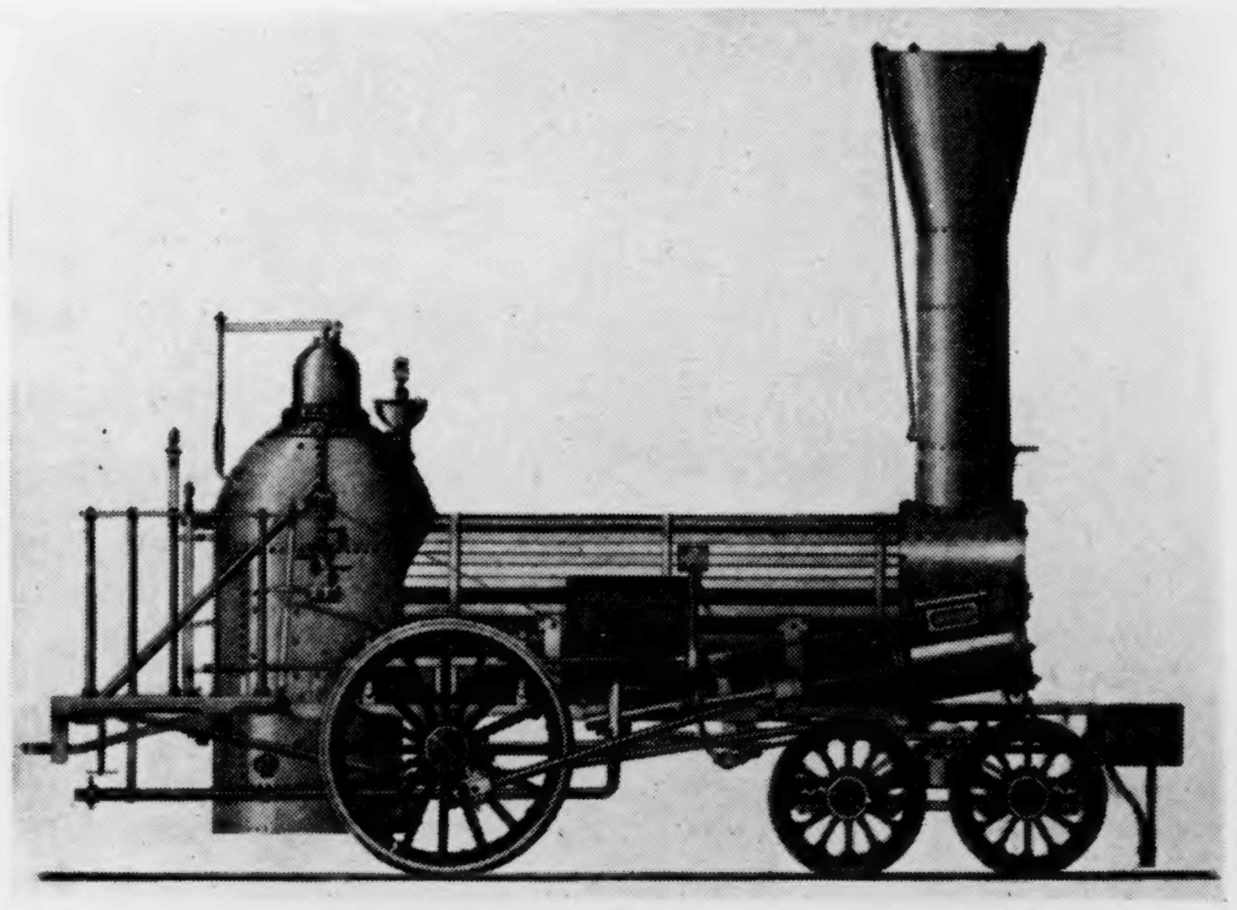

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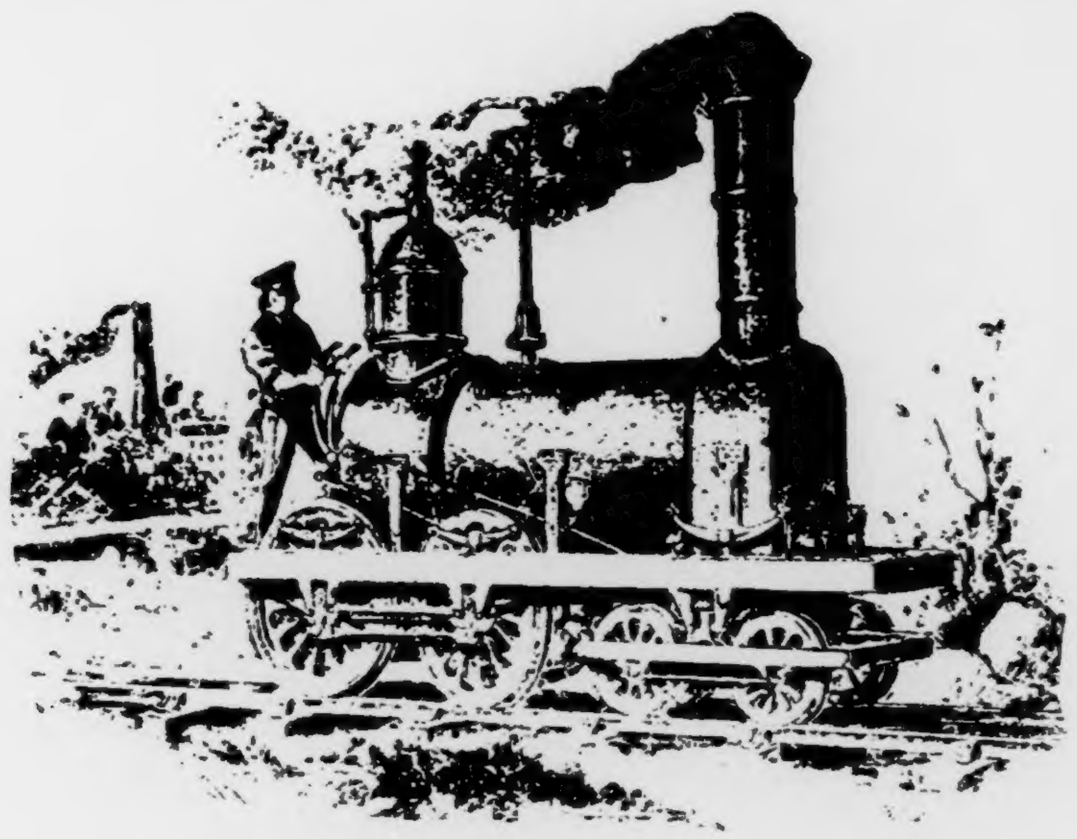

Campbell's Eight-wheeled Locomotive, 1836

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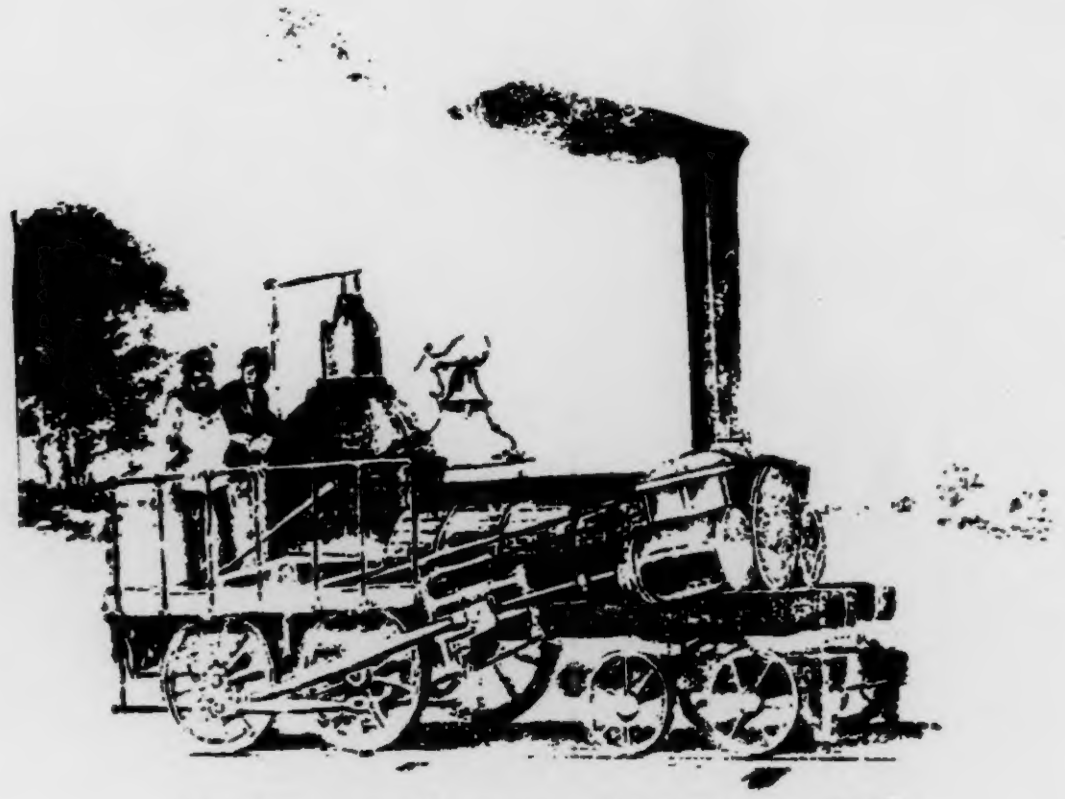
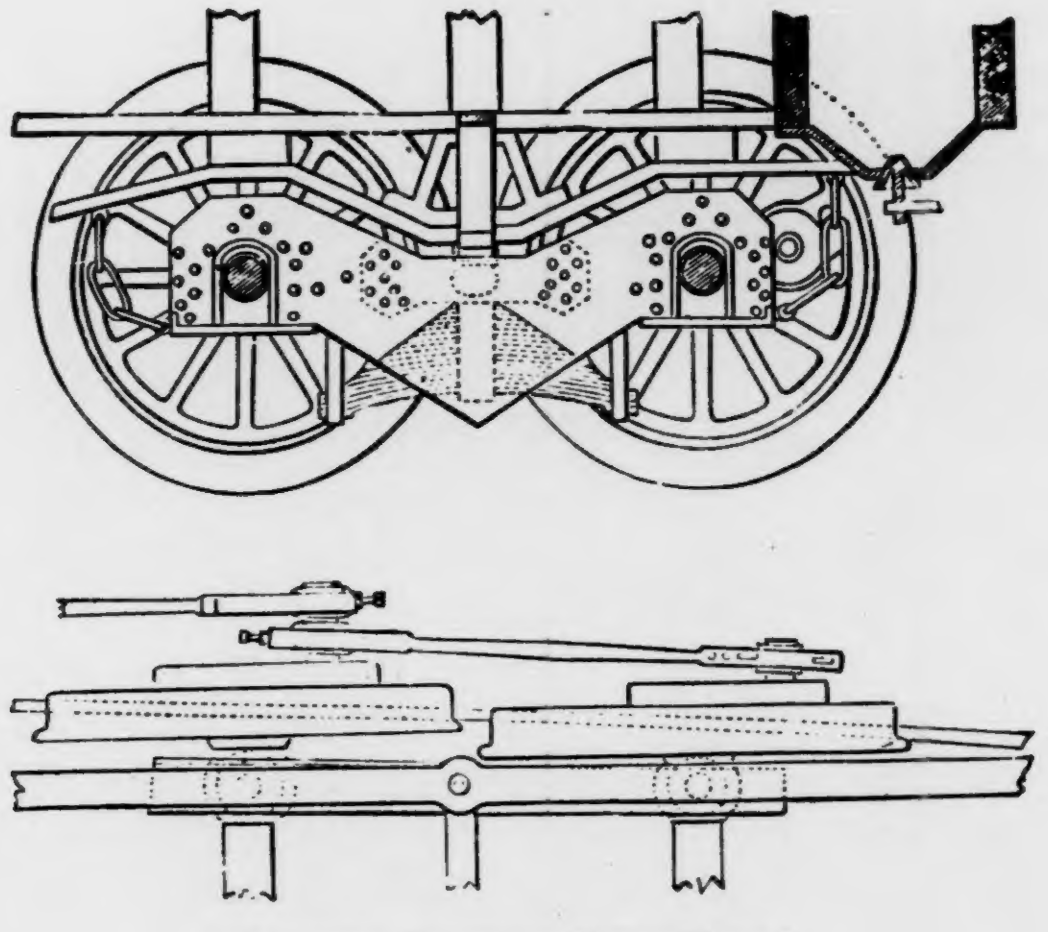
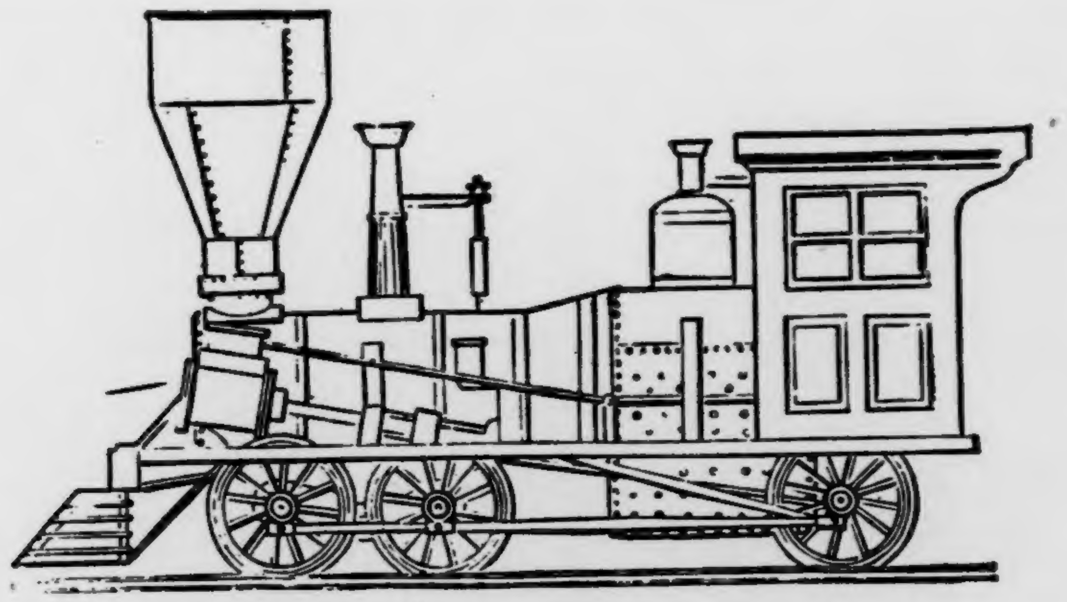
In 1837, however, Garrett & Eastwick of Philadelphia built a locomotive for the Beaver Meadow Railroad, and introduced an equalizing bar between the two pairs of drivers, which device was patented by Joseph Harrison, Jr., who later became a member of the firm known as Eastwick & Harrison. Quick to perceive the value of this device, Mr. Baldwin was so pleased with it that he purchased from Eastwick & Harrison the right to use and apply it to all the locomotives he might thereafter build.



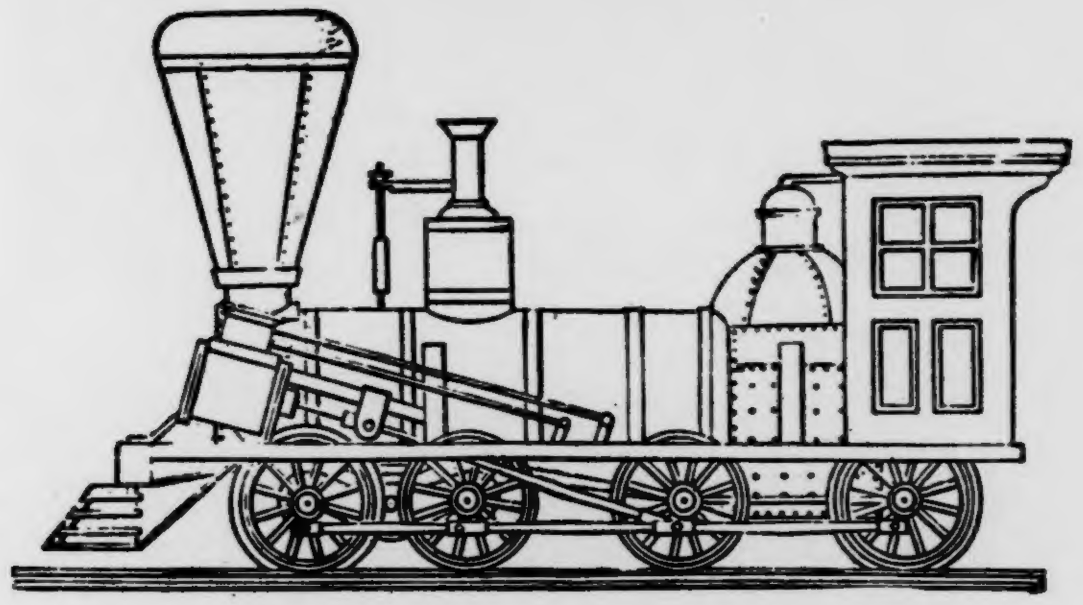
GARRETT AND EASTWICK LOCOMOTIVE 1837



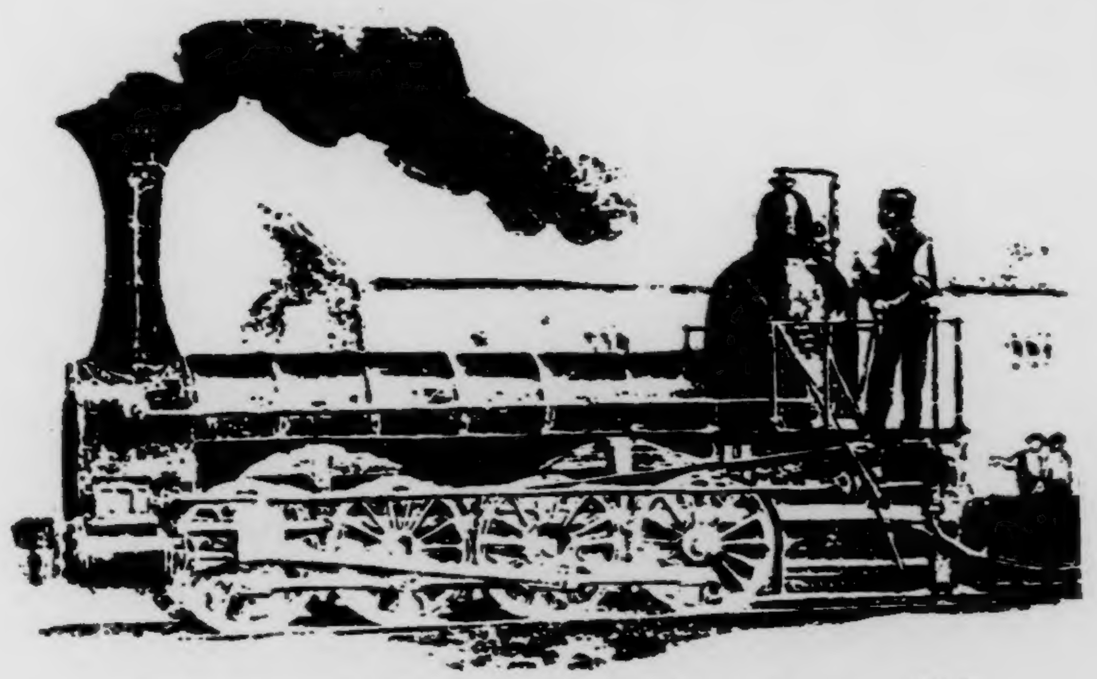
BALDWIN FLEXIBLE BEAM TRUCK



BALDWIN SIX-COUPLED LOCOMOTIVE, 1842

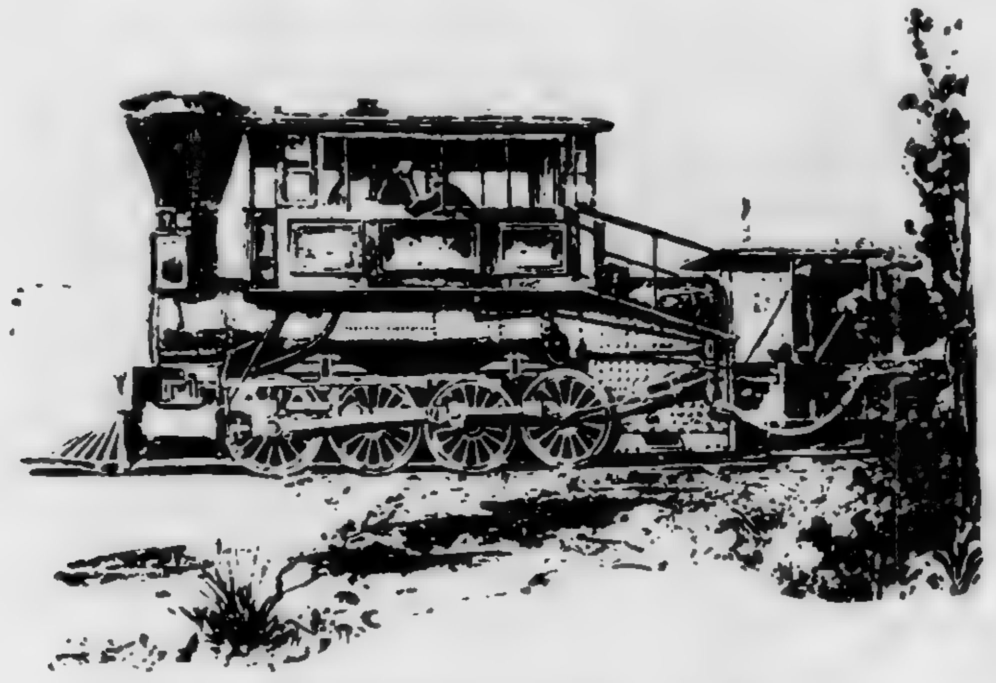


BALDWIN EIGHT-COUPLED LOCOMOTIVE, 1846

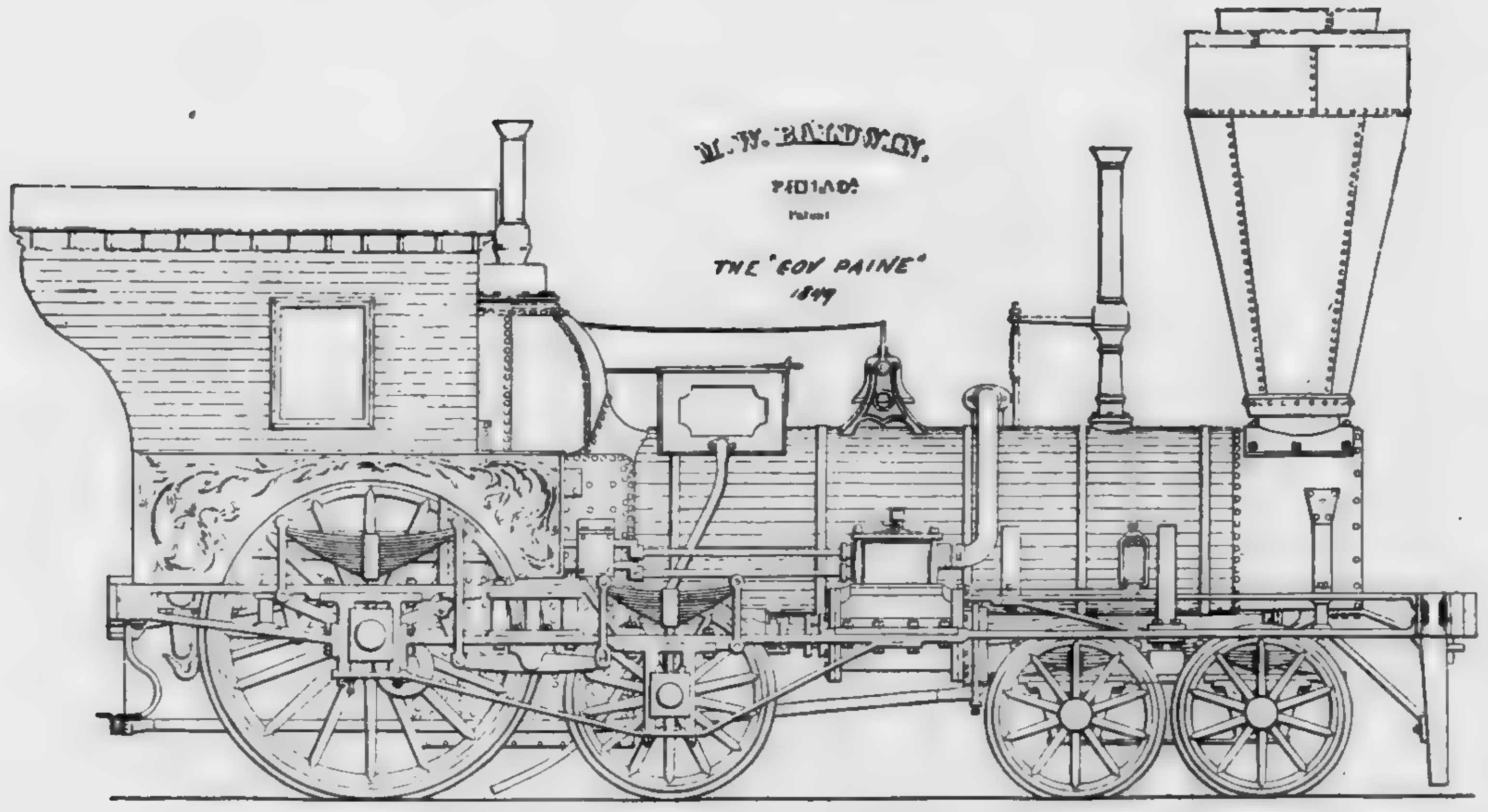


ROSS WINANS' EIGHT-COUPLED LOCOMOTIVE, 1846

Mr. Baldwin, ever aggressive, felt that for moving the heavy traffic which the railways then were called upon to handle required locomotives of greater power than any previously built. He conceived the idea of a flexible beam truck which would enable him to build locomotives with six coupled wheels. Such locomotives were put in service in 1842, and in the year 1846 had grown into a design using eight coupled drivers, the first two pairs being combined in the flexible truck. The largest locomotives of this type weighed about 30 tons. Ross Winans, of Baltimore, in this same year produced a locomotive with four pairs of drivers coupled, but very compactly grouped and held in a rigid frame. It is therefore doubtless due to his courage that there was introduced and generally adopted the rigid frame construction now employed in our most powerful locomotives. The most notable of these Winans locomotives were the famous Camel engines, which were among the most powerful freight haulers of their day and were built in large numbers up to 1860.

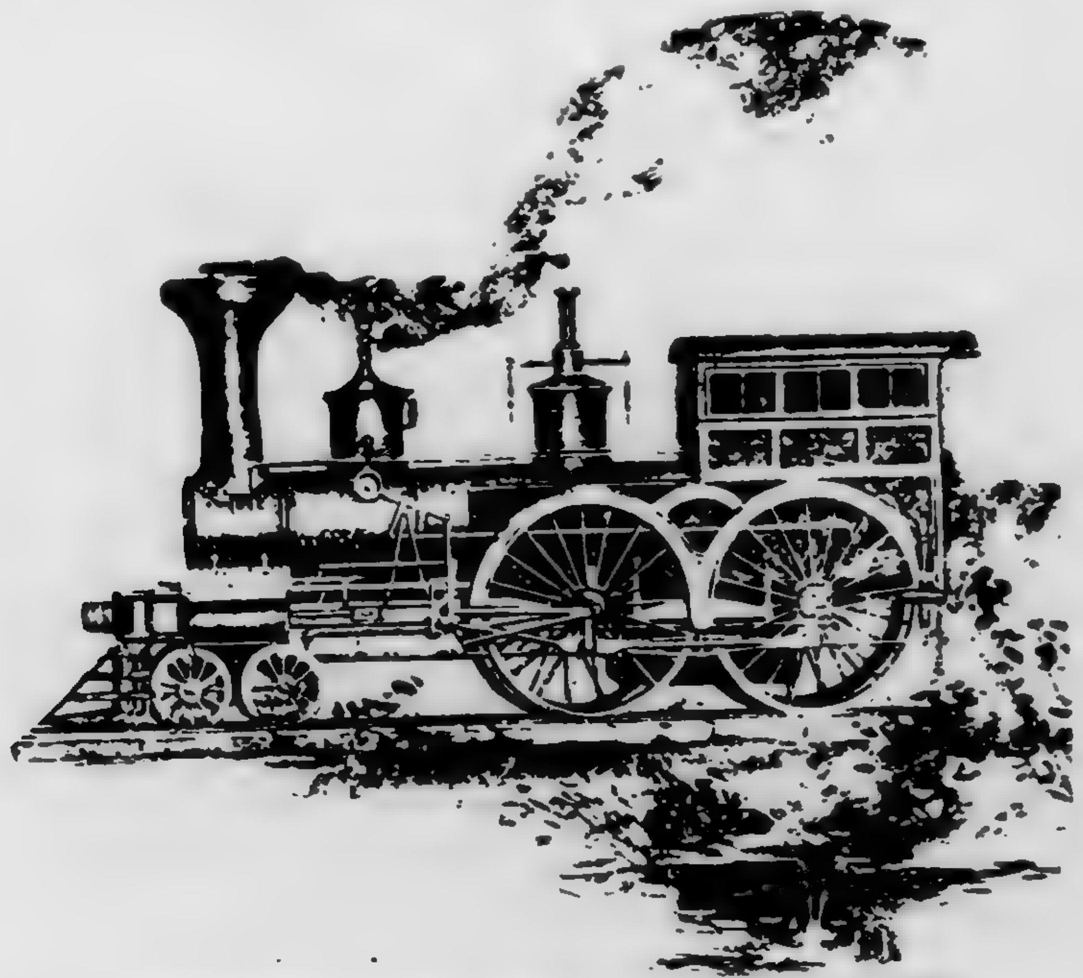


A ROSS WINANS' "CAMEL" OF 1851



THE "GOV. PAINE," BUILT FOR THE CENTRAL VERMONT RAILROAD IN 1849

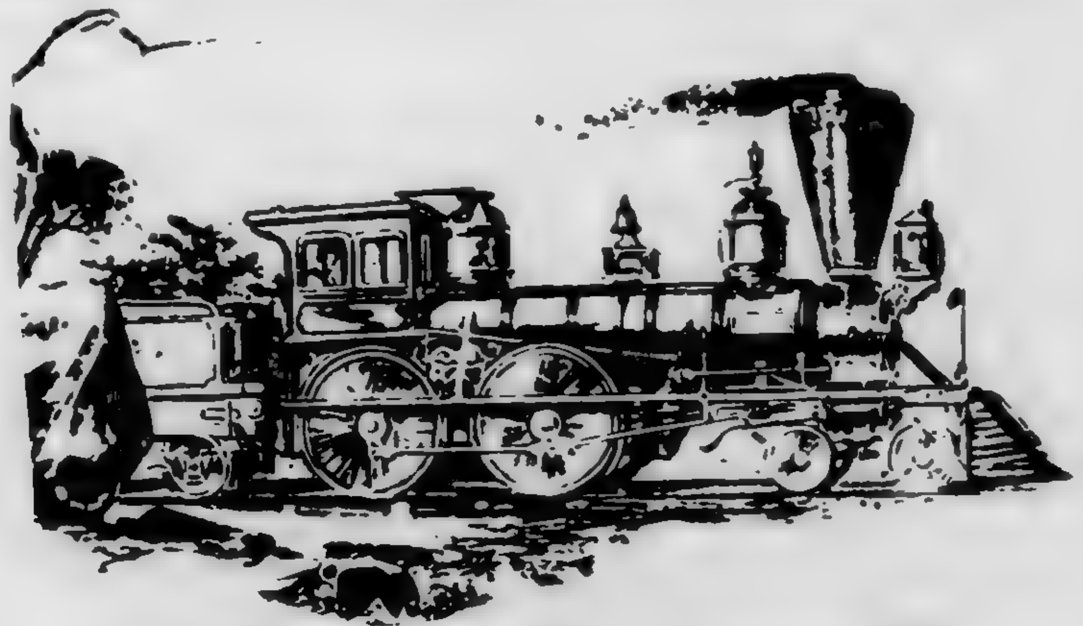
In the late '40's and early '50's the public desire for more rapid passenger service led to the employment of large driving wheels for this class of transportation. Mr. Baldwin, first in the field with the "Governor Paine," gave great impetus to the desire for better passenger locomotives. James Milholland, of the Philadelphia & Reading Railway Co., whose work in the development of the locomotive will pass down into history, in 1852 constructed for



MILHOLLAND FAST PASSENGER LOCOMOTIVE, 1852

that Railway passenger engines having driving wheels 7 feet in diameter. In detail of design, the Milholland engines were undoubtedly among the finest of their time.

The "Tiger," built by Mr. Baldwin in 1856, for the Pennsylvania Railroad Company, was one of the most successful passenger locomotives of that

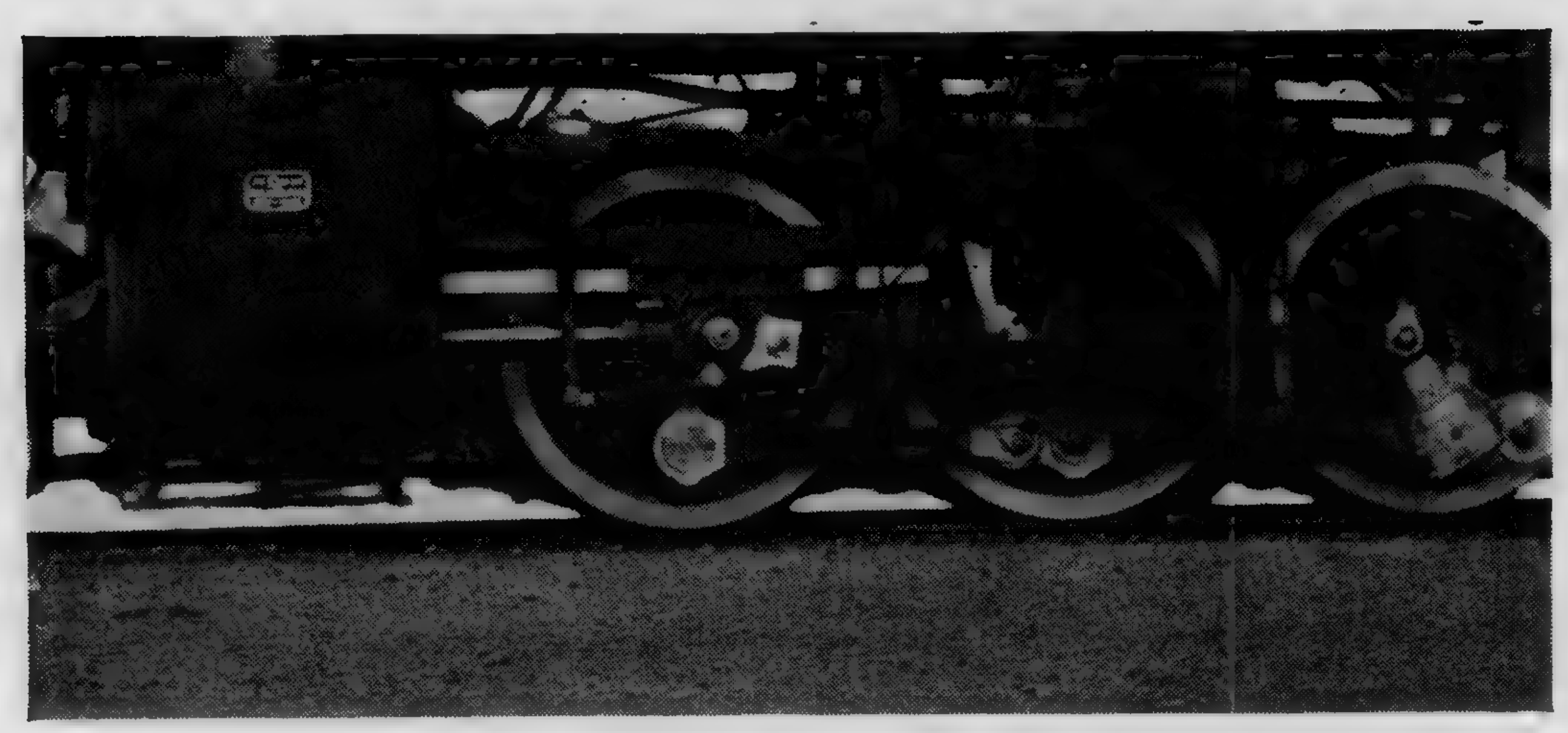


"THE TIGER," PENNSYLVANIA RAILROAD, 1856

period. It used wood for fuel and its total weight was some 28 tons. In this same year an engine of this type was built for service in the South and is still working every day at Valdosta, Ga., being in its sixty-eighth year. It may be worth while to mention that this locomotive was born the same year as the speaker, and like your humble servant, while showing somewhat the ravages of time, is still able to make some smoke.

During the period of the Civil War almost anything that would run on wheels in the shape of a locomotive was acceptable. Many remodelings were made of antiquated structures, and locomotive designers became quite as

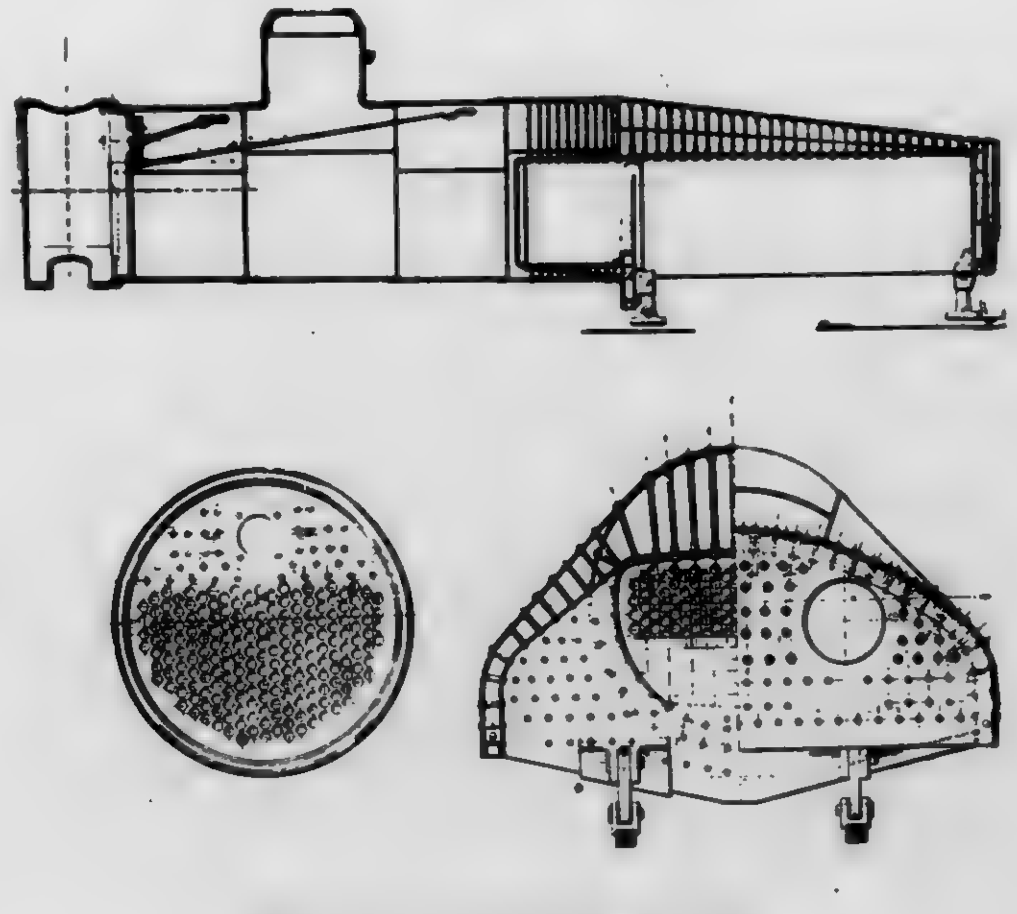
A BALDWIN LOCOMOTIVE BUILT IN 1856 AND STILL IN SERVICE



LAIRD GUIDE AS APPLIED TO A MODERN LOCOMOTIVE

numerous as the locomotives themselves. John P. Laird, at the Altoona Shops of the Pennsylvania Railroad Company, was most active, and some of his improvements, as for instance the Laird guide, exist today. Much was accomplished, and during the years intervening some of our railway systems began to consider standardization of their power. This was most consistently and determinedly put in force by the Pennsylvania Railroad Company, and the changes of types on that system, while made regularly in order to keep abreast of the times, have always been given the most conservative consideration before adoption.

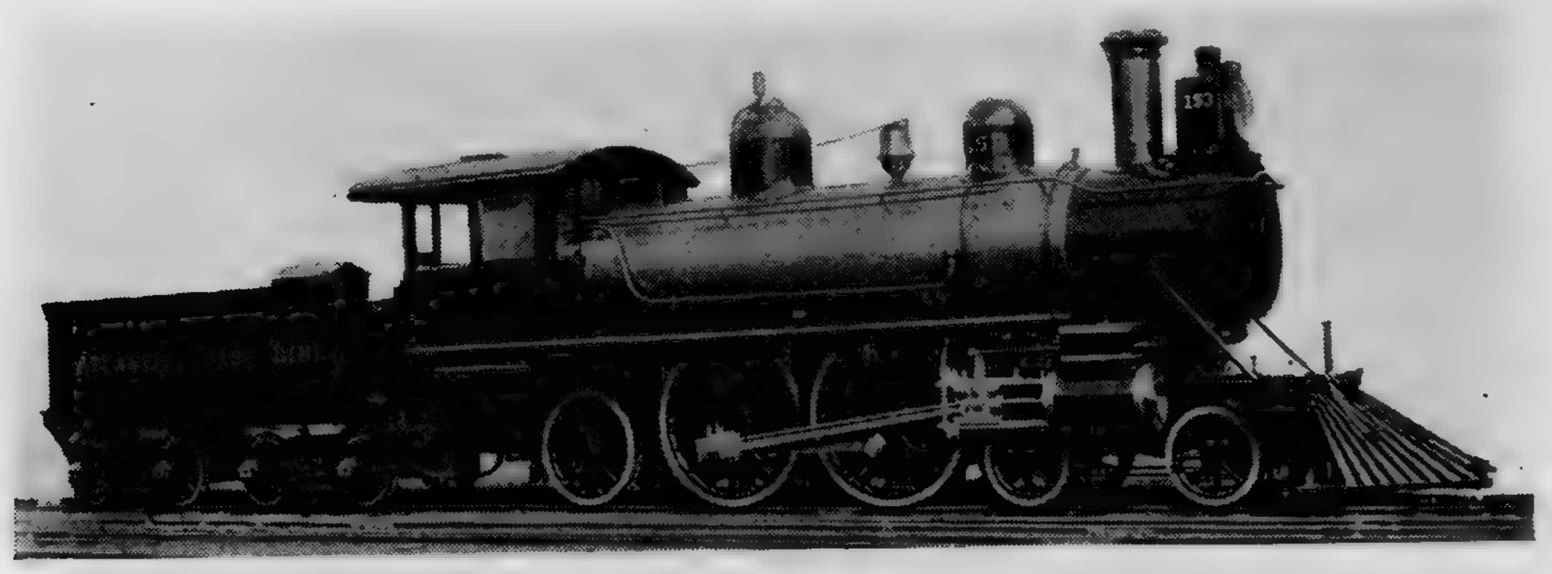
It was not until 1877 that interest was taken by the Philadelphia and Reading Railway in locomotives to burn the refuse anthracite coal then produced in large quantities at the mines, and for which no market was available. The first locomotive of this character was designed by John E. Wootten,



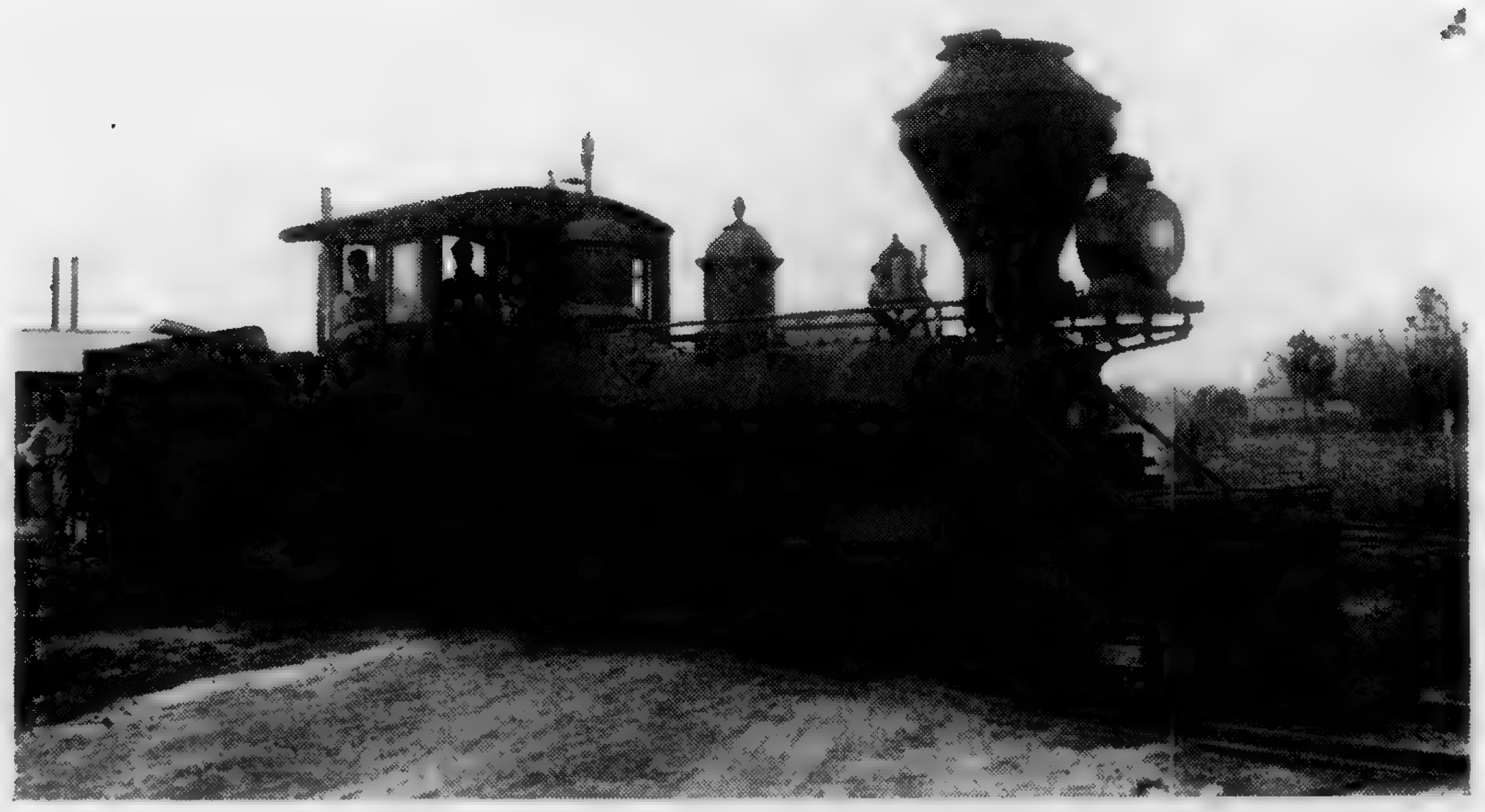
WOOTTEN TYPE BOILER, 1877

of the Railway Company, and was quite successful. It was at that time considered quite an innovation; but owing to the increased demand since made upon the steam generators of locomotives, the use of the Wootten boiler has developed what is known as the wide firebox boiler, now used with all kinds of fuel and in all classes of service. The Wootten design was a great departure and in my opinion did more for development and increased locomotive power than any other improvement of that period. It was quite a while before the merits of this construction were acknowledged, but it is now universally used.

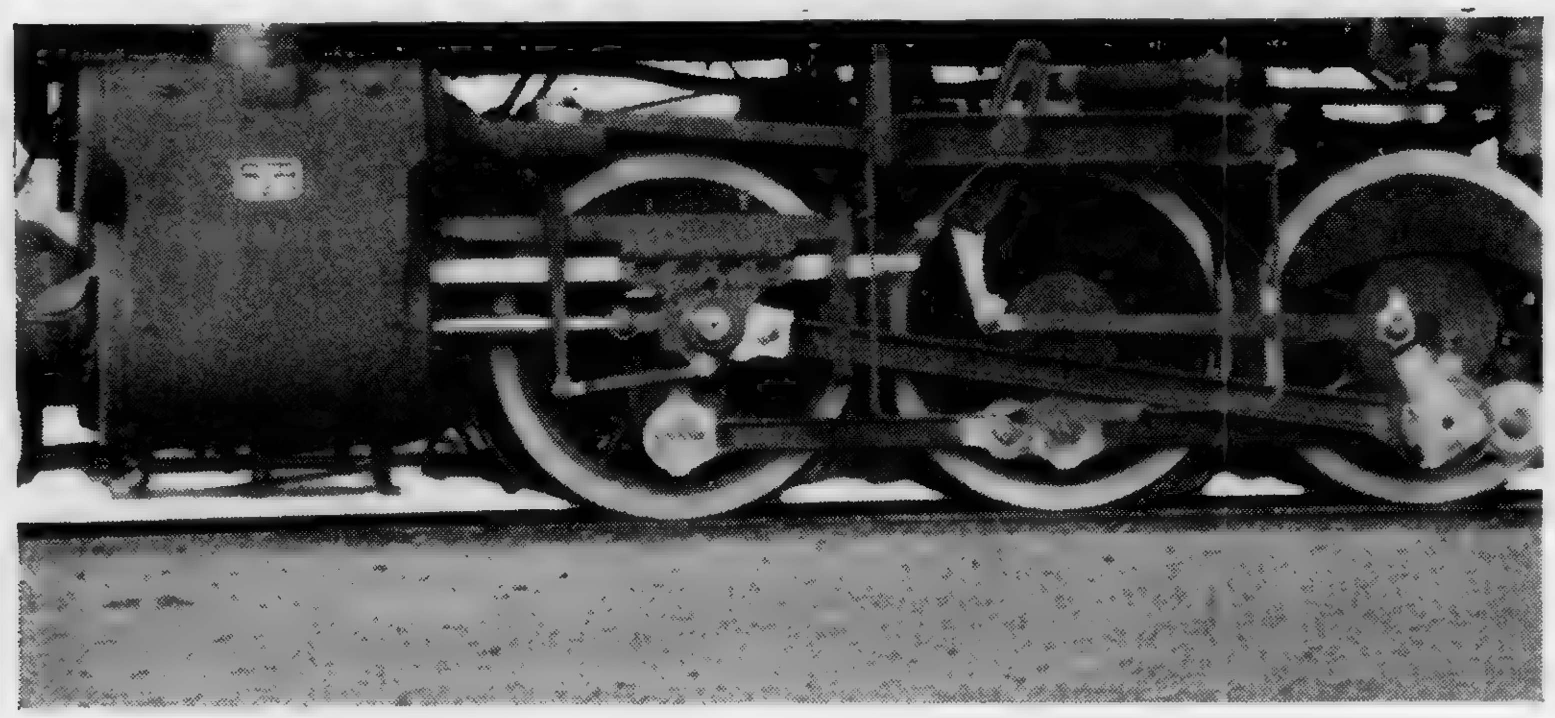
The desire for high speed with large trains where great tractive power was not necessary, led to the introduction, in 1894, of what is known as the Atlantic type locomotive, built to meet the requirements of the Atlantic Coast Line. This type was so successful that it became almost universally employed in passenger service, though under various names such as the Central Atlantic type, Chatauqua, etc. The underlying principle in each



ATLANTIC TYPE LOCOMOTIVE, ATLANTIC COAST LINE



A BALDWIN LOCOMOTIVE BUILT IN 1856 AND STILL IN SERVICE



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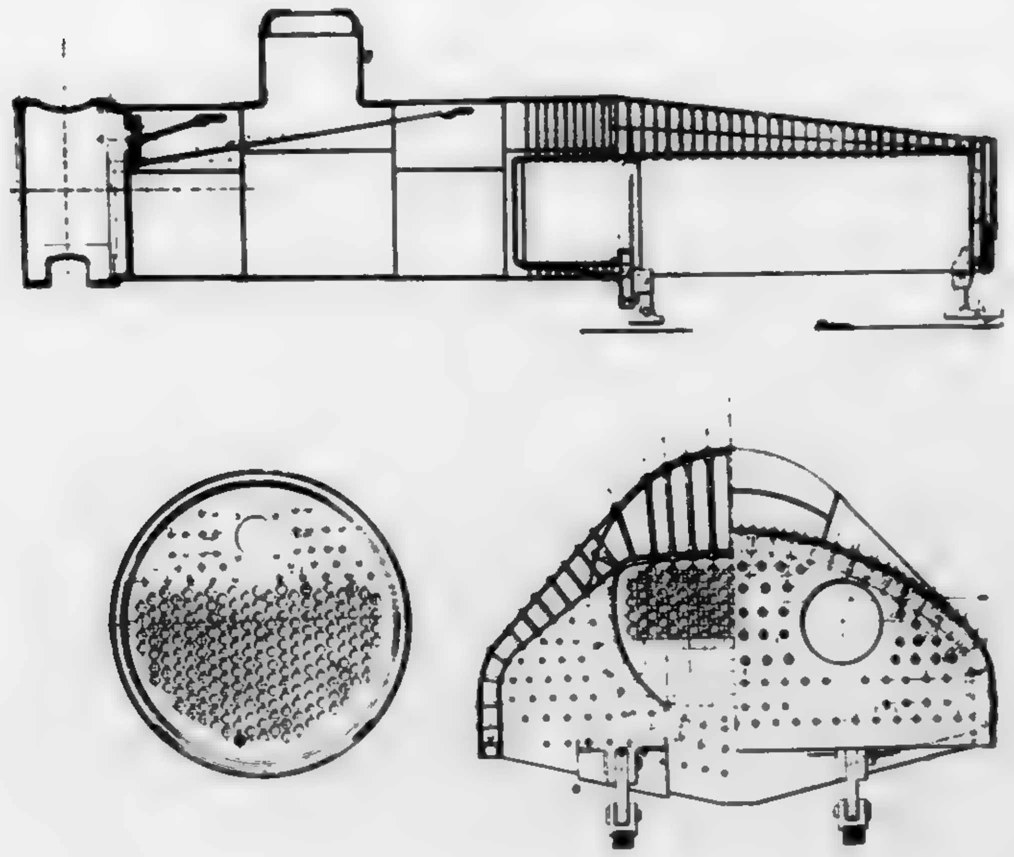

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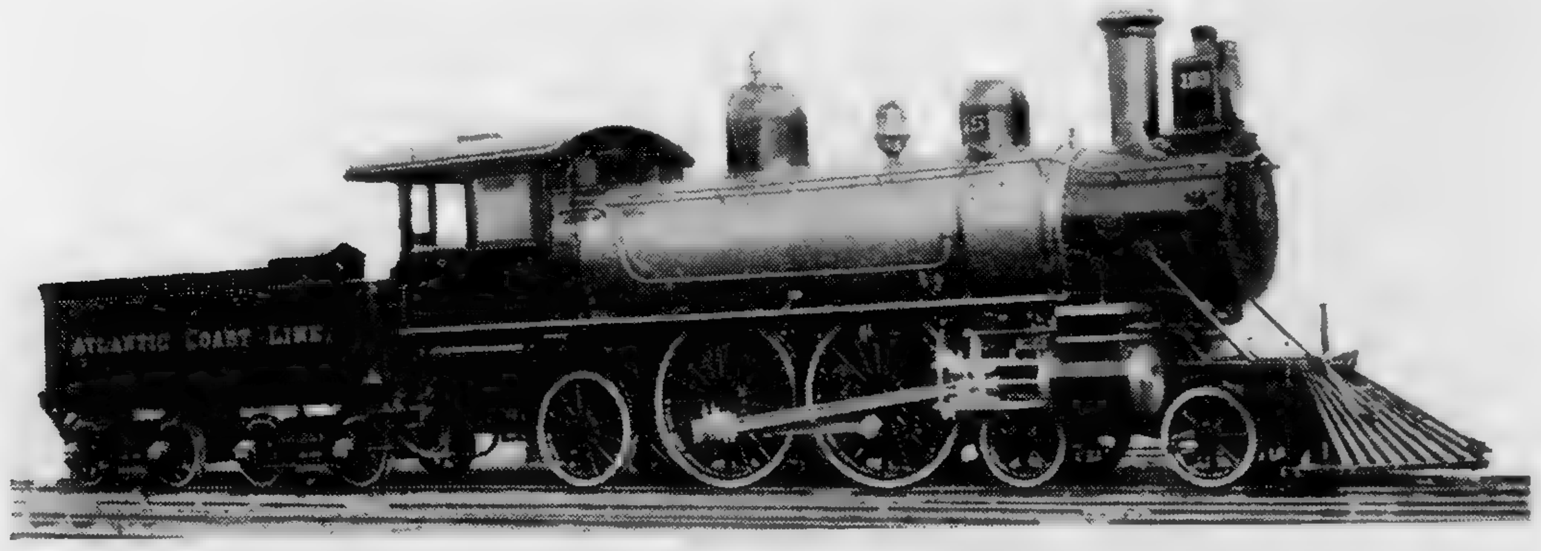
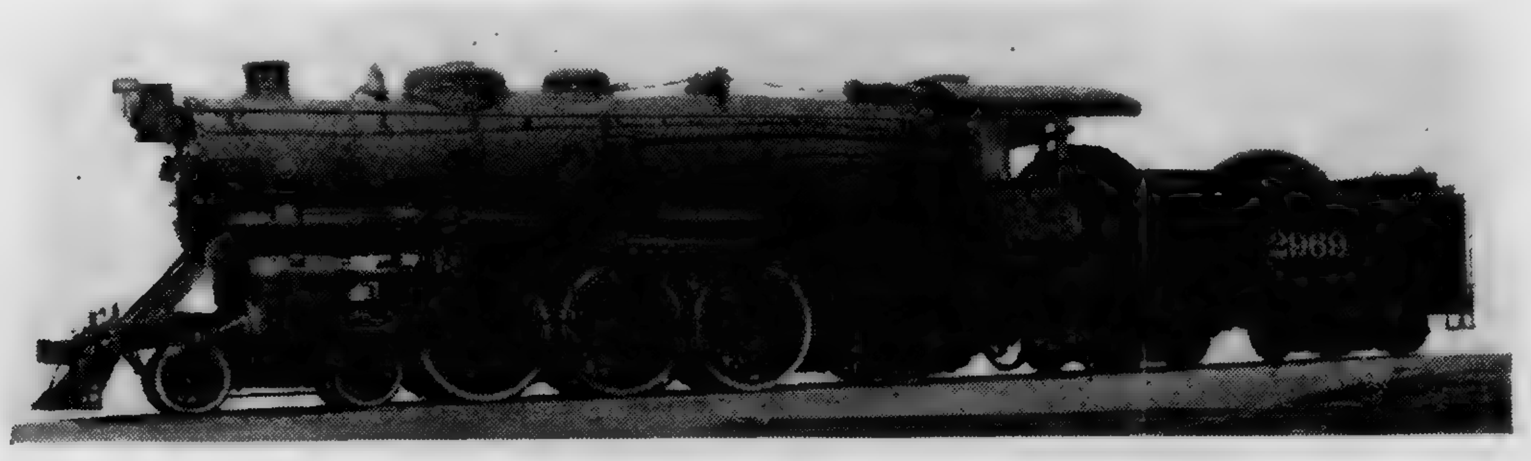
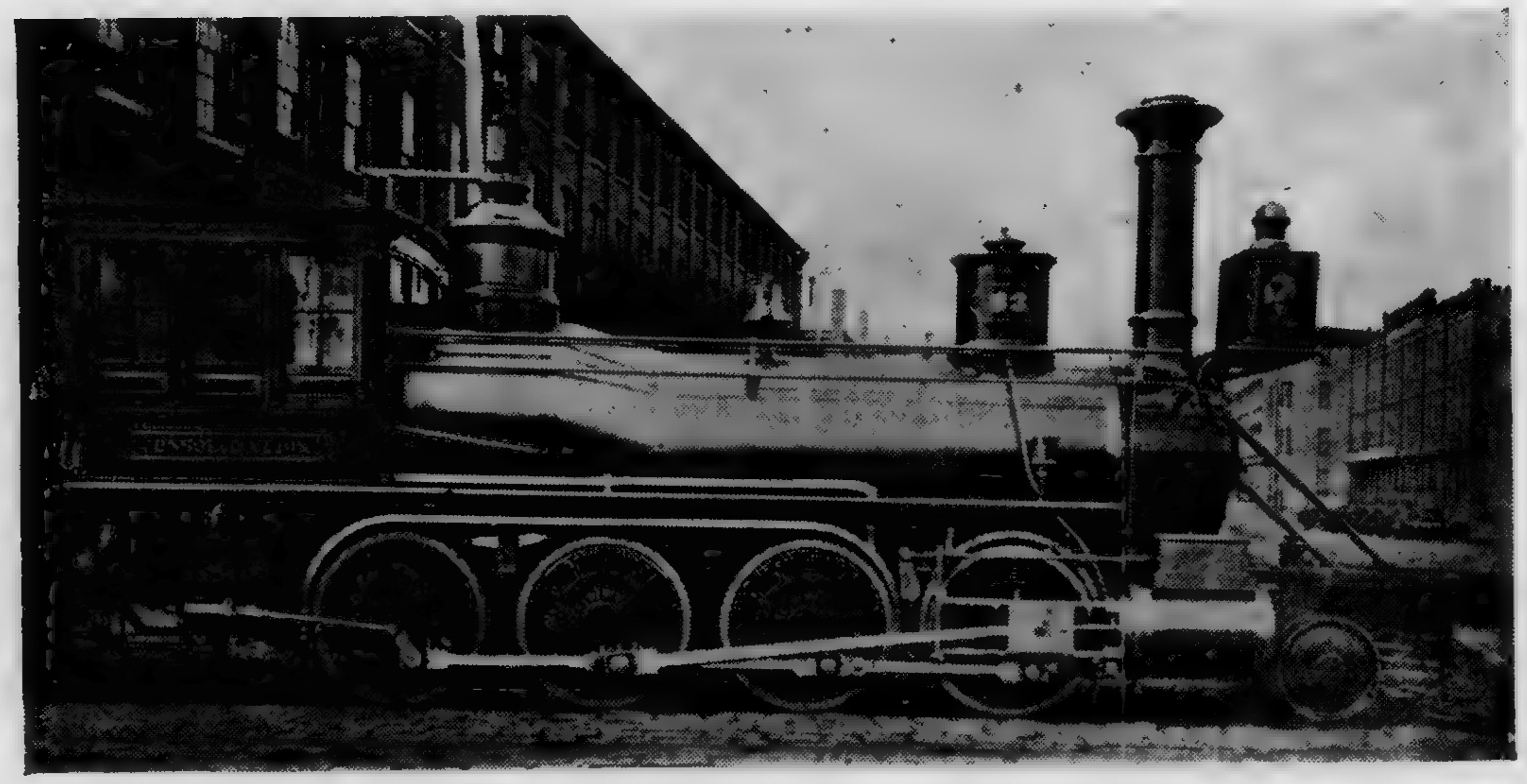


ATLANTIC TYPE LOCOMOTIVE, ATLANTIC COAST LINE



PACIFIC TYPE LOCOMOTIVE, BURLINGTON SYSTEM

MOUNTAIN TYPE PASSENGER LOCOMOTIVE, SANTA FE SYSTEM



THE ORIGINAL CONSOLIDATION TYPE LOCOMOTIVE,
LEHIGH VALLEY RAILROAD, 1866

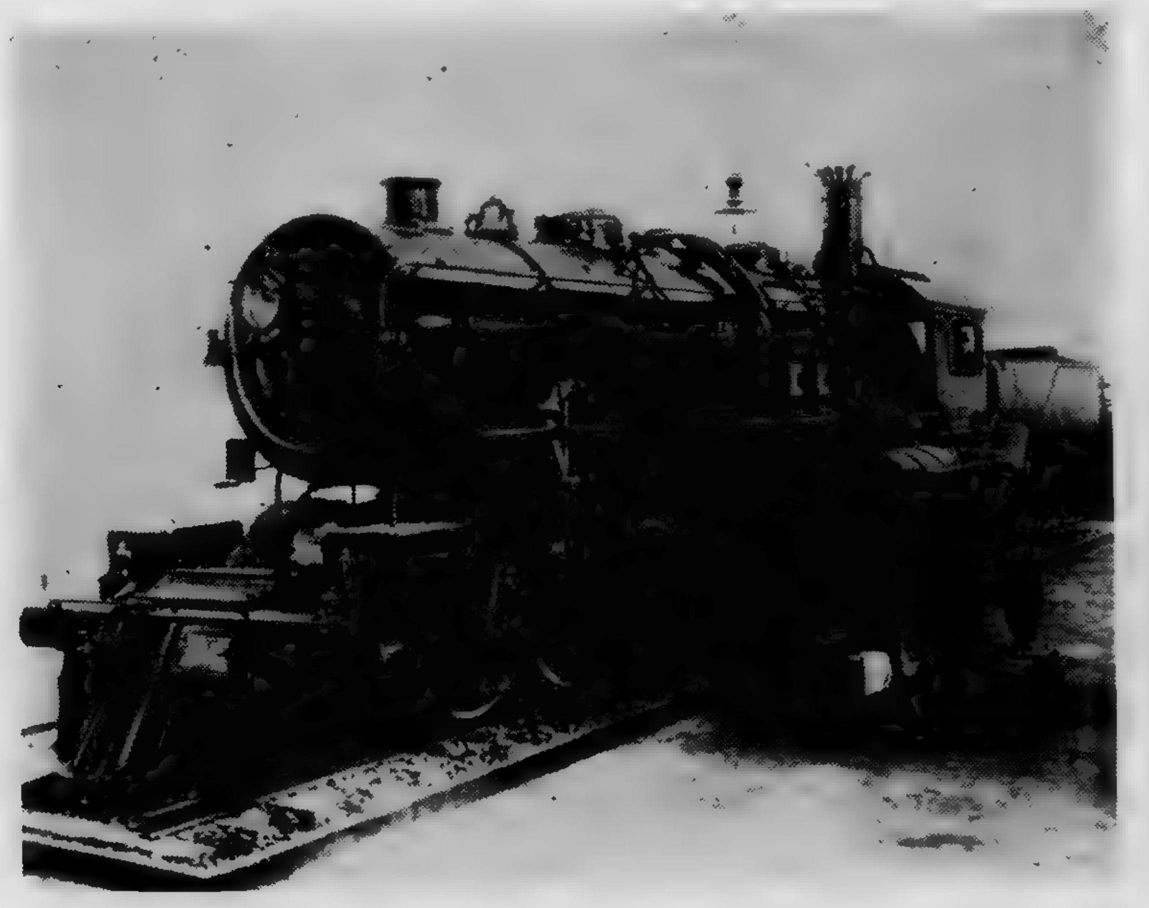
case was the same, namely, the use of the trailing wheel to carry the excess load involved by the employment of a boiler of exceptional steaming capacity and having a deep firebox suitable for burning bituminous coal.

MODERN HEAVY CONSOLIDATION TYPE LOCOMOTIVE, WESTERN MARYLAND RAILWAY

The increased requirements of transportation, i. e., sustained high speeds with heavy trains, produced what is now commonly known as the Pacific (4–6–2) type locomotive, which is in general use throughout the country for heavy passenger service. For the heaviest class of service on steep grades, the Mountain (4–8–2) type is now being successfully employed.

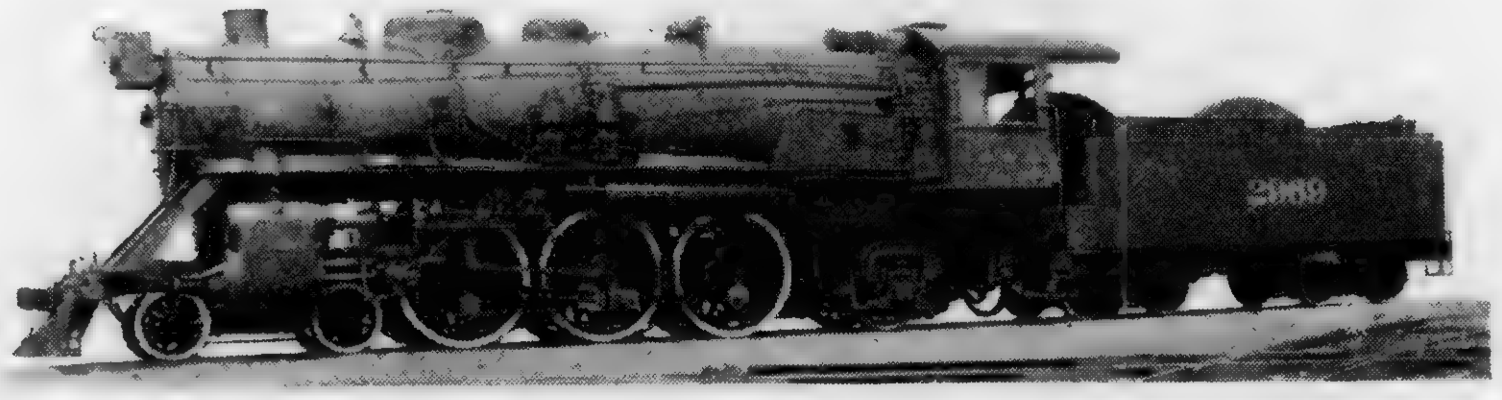
The first so-called Consolidation type locomotive, built by The Baldwin Locomotive Works in 1866, was named in honor of the consolidation of the various small railway lines now comprising the Lehigh Valley System. It was a great success, and upon the same principles, Consolidation locomotives of enormous size and great efficiency have continued to be built.

About the year 1889, American locomotive designers became deeply interested in the compounding of locomotives. A considerable number of compounds of various types had been built and operated abroad. Almost any single expansion type then constructed was capable of having compound cylinders of some design applied, resulting in a more economical performance.

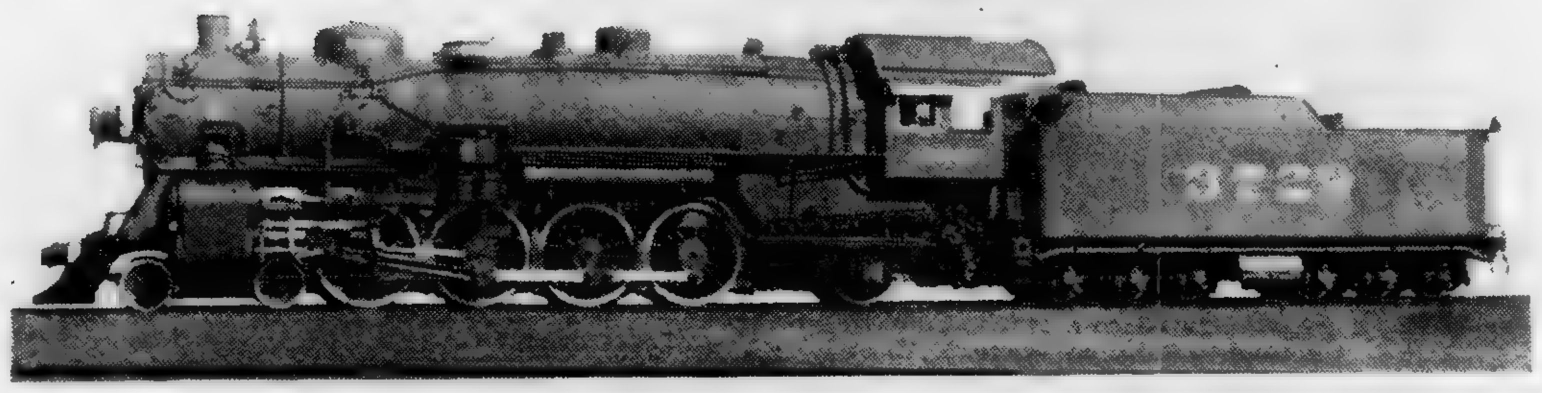


MALLET ARTICULATED LOCOMOTIVE, BALTIMORE AND OHIO RAILROAD,
STANDING BESIDE MODEL OF STEPHENSON'S "ROCKET"

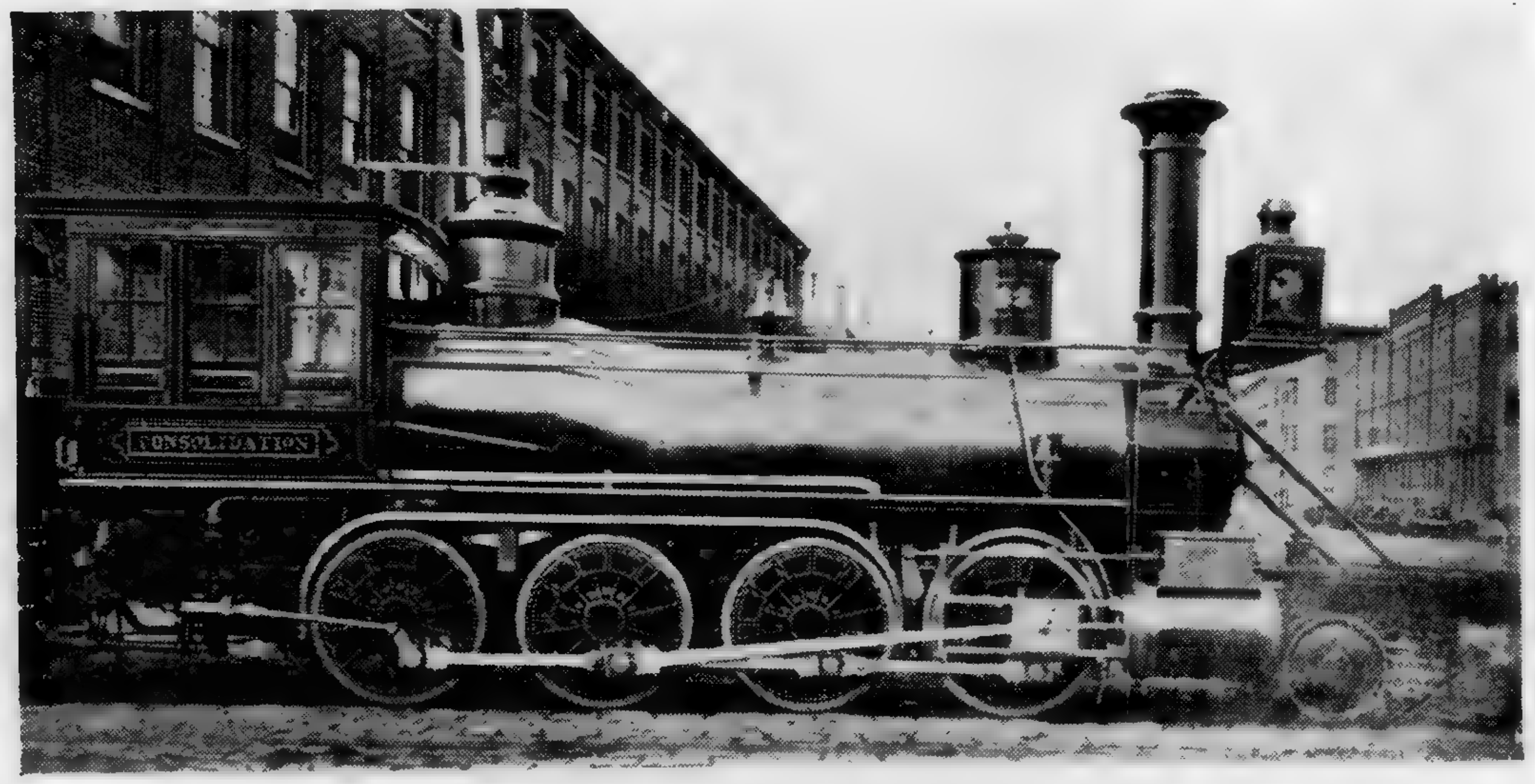
Among the various types in use abroad were four-cylinder Mallet locomotives, originally designed for light service, and later built in large sizes for use in Russia. The first locomotive of this type built in the United States was



Pacific Type Locomotive, Burlington System



Mountain Type Passenger Locomotive, Santa Fe System



The Original Consolidation Type Locomotive,
Lehigh Valley Railroad, 1866

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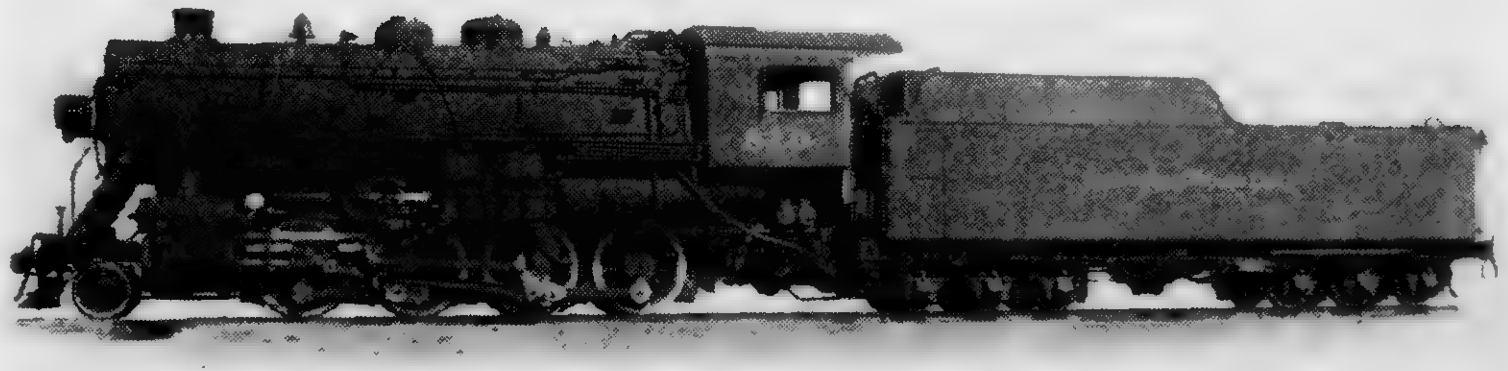

Modern Heavy Consolidation Type Locomotive, Western Maryland Railway

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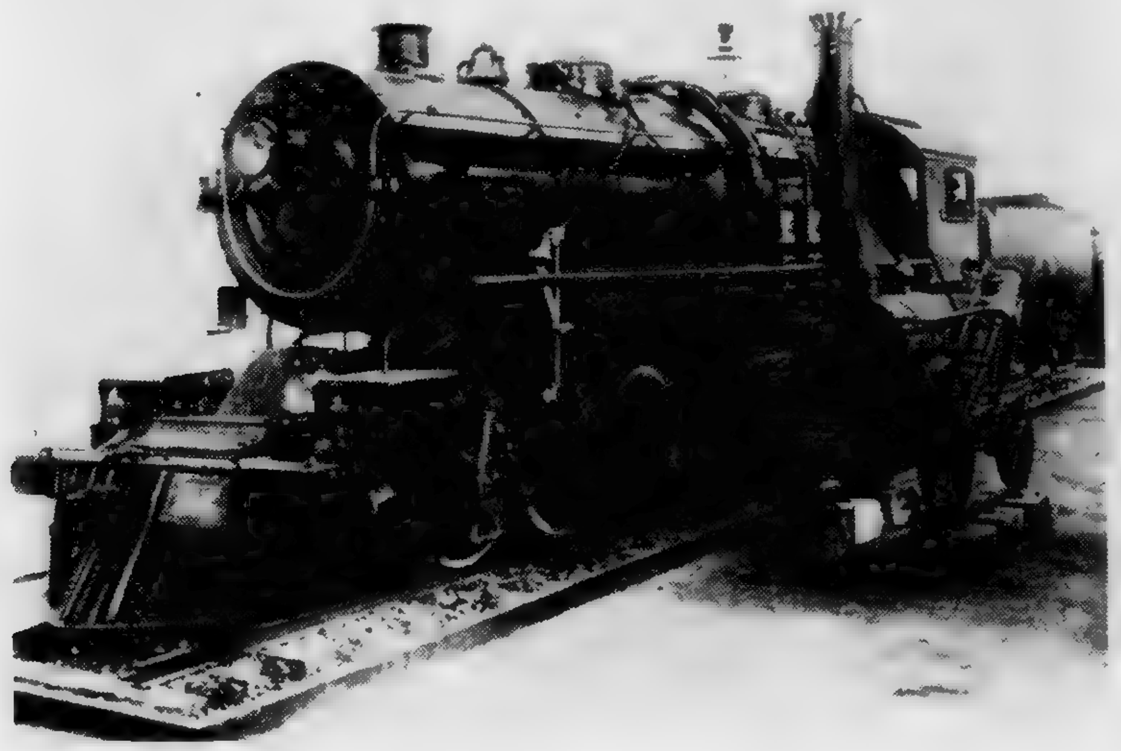


Mallet Articulated Locomotive, Baltimore and Ohio Railroad,
Standing Beside Model of Stephenson's "Rocket"

Among the various types in use abroad were four-cylinder Mallet locomotives, originally designed for light service, and later built in large sizes for use in Russia. The first locomotive of this type built in the United States was purchased by the Baltimore & Ohio Railroad Co., and had two six-coupled units. It was built by the American Locomotive Company and was exhibited at the St. Louis Exposition in 1904, and later operated very successfully in mountain service. But inasmuch as this was a single locomotive, the type did not receive the attention or create sufficient interest among railway managers to come quickly into general use; and it was not until 1906, when Mr. James J. Hill, of the Great Northern Railway Co., purchased five of these engines on my recommendation, that wide-spread interest in the type was created. In order to get a proper estimate of their value, he isolated them and placed them on one section of the Road, removing the locomotives of all other types. These locomotives were equipped with leading and trailing trucks, but in other respects were of the same type as the locomotive that had been previously constructed and put in use on the Baltimore & Ohio Railroad. The experiment was successful and Mallet locomotives for steep gradients or extreme conditions of traffic became popular and are still in general use.

MALLET ARTICULATED LOCOMOTIVE, GREAT NORTHERN RAILWAY

MALLET ARTICULATED LOCOMOTIVE, BALTIMORE AND OHIO RAILROAD

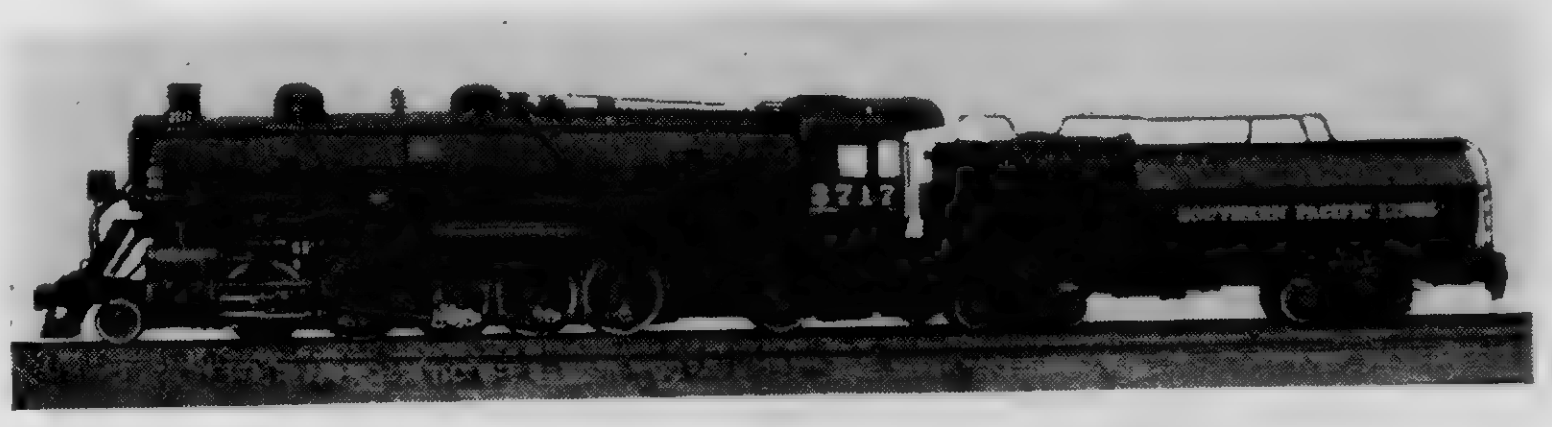
COMPOUND FAST PASSENGER LOCOMOTIVE PHILADELPHIA & READING RAILWAY

Notwithstanding the fact that compound locomotives proved their economy and gave wonderful results, so far as economical consumption of fuel in freight service and high speed hauling power in passenger service were concerned, owing to the clearance limits prescribed, the constantly increasing size of locomotives made the use of compound cylinders more and more difficult.

The use of superheated steam about this time, however, enabled engineers to produce locomotives almost, if not quite, as efficient as the compound locomotives had proven themselves to be, and to still further enlarge the size of units, increase their power and maintain a most satisfactory performance.

In this connection, mention should be made of two types of locomotives which have proved particularly successful in heavy freight service. These are the Mikado (2-8-2) and the Santa Fe (2-10-2). In both of these the trailing wheel principle as originated in the Atlantic type, has been applied for the purpose of providing increased boiler capacity. Furthermore, in freight and pushing service there is an added advantage in the trailer, as it provides a guide when running backward. Largely for this reason, the Mikado type has proved a great success in meeting the special conditions found in logging and certain other classes of service where it is frequently necessary to back into sharp curves and switches.

U. S. R. A. MIKADO TYPE LOCOMOTIVE FOR BALTIMORE AND OHIO RAILROAD



2-10-2 TYPE LOCOMOTIVE, SOUTHERN PACIFIC COMPANY

The standardization of locomotives by the Railway Administration was of great benefit, as the consideration of the designs resulted in a much closer intercourse and exchange of thought among motive power men than could have been obtained in any other way; and while none of the classes then developed will be continued in their entirety, many of the more recent locomotive designs have as their bases the Administration locomotives.

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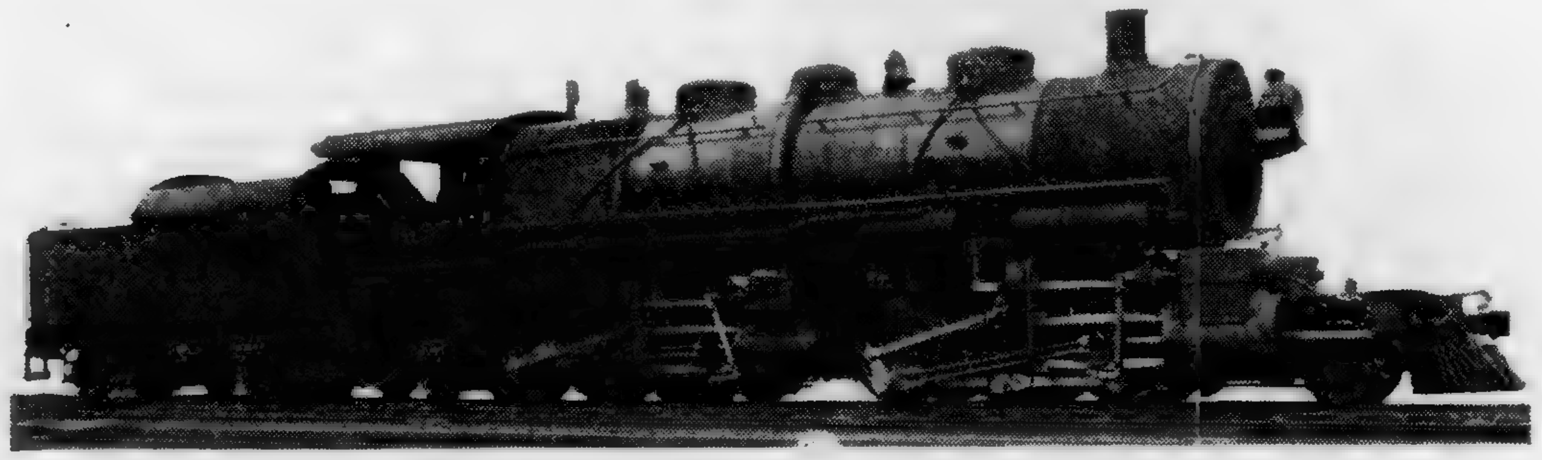
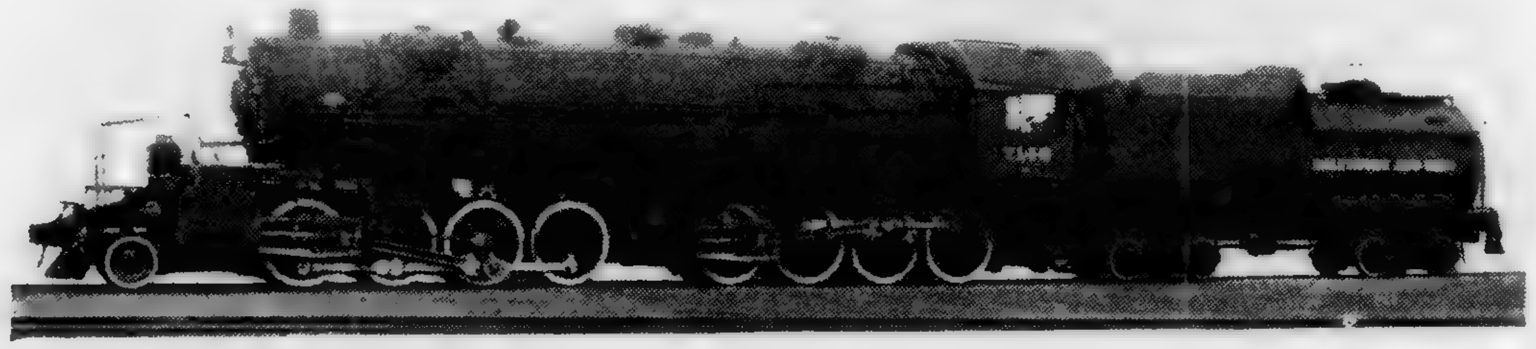
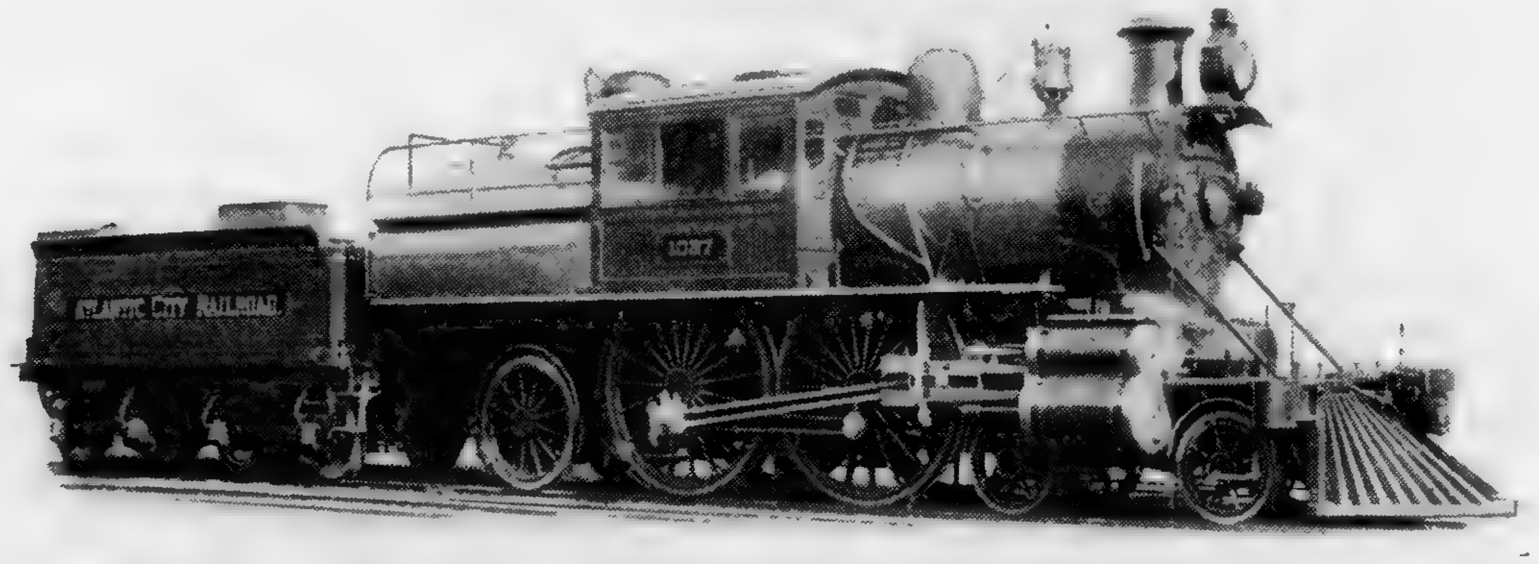


Mallet Articulated Locomotive, Great Northern Railway



Mallet Articulated Locomotive, Baltimore and Ohio Railroad



Compound Fast Passenger Locomotive Philadelphia & Reading Railway

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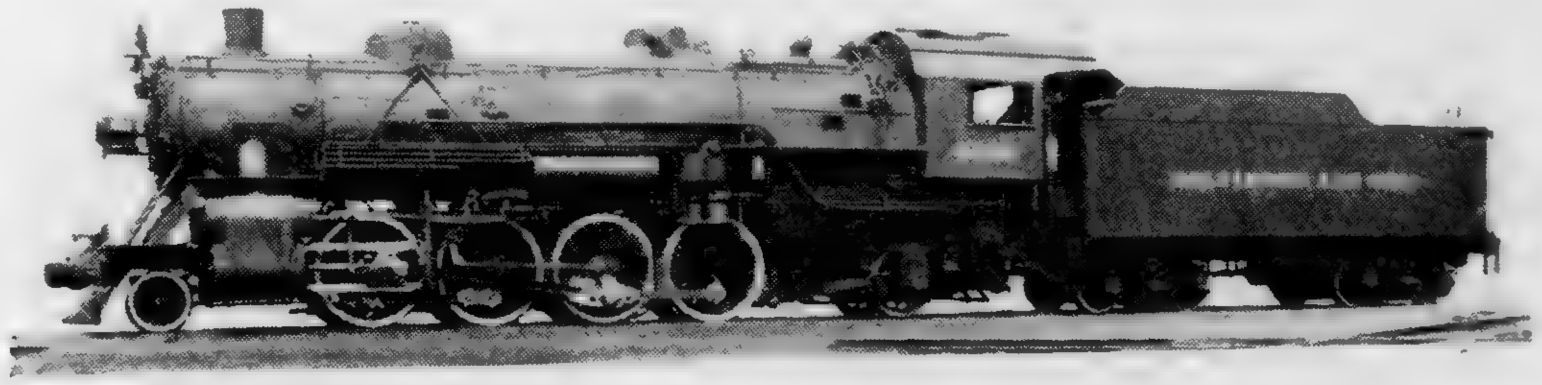

U. S. R. A. Mikado Type Locomotive for Baltimore and Ohio Railroad

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2–10–2 Type Locomotive, Southern Pacific Company

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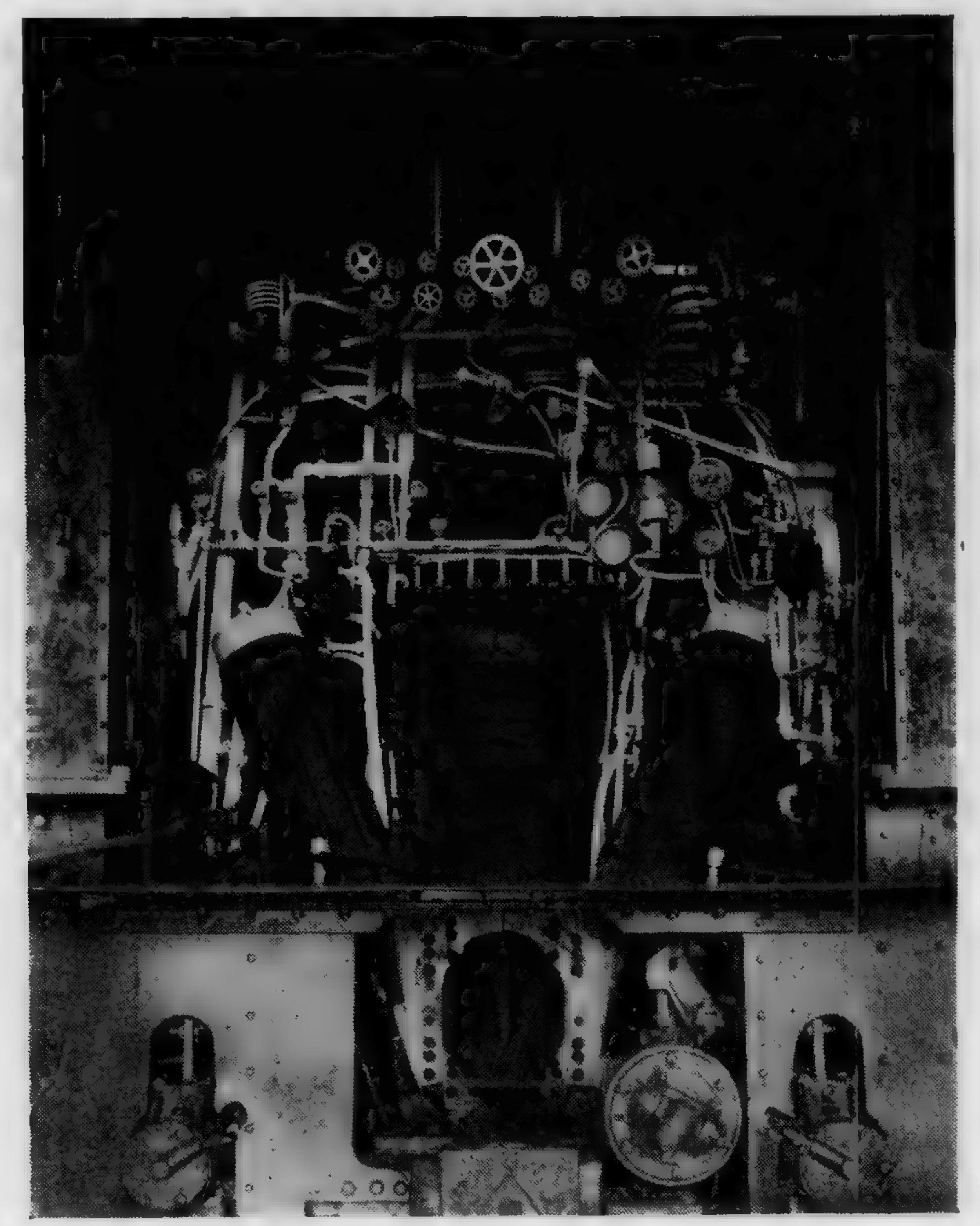
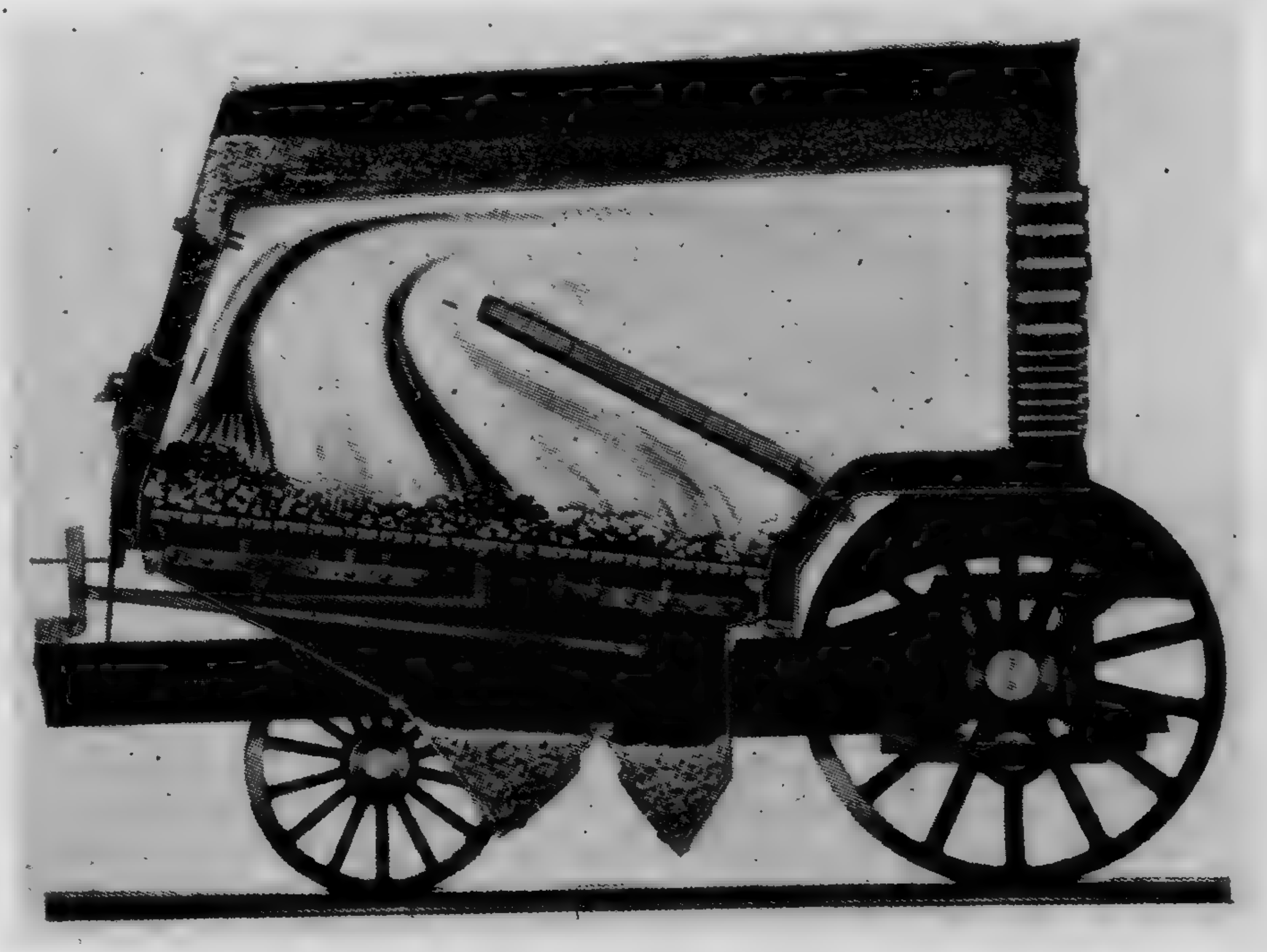
There has at all times been an unceasing effort on the part of railway managers to use locomotives not only of greater capacity, but also of greater economy. Determined and loyal support has been given to every invention or contrivance intended to improve the efficiency of the locomotive and thus enable it to accomplish more work. To one who has given his whole life to this work and who has had opportunity to note the changes made from time to time in locomotive designs and appliances, the modern locomotive may be looked upon with some satisfaction; but also with a realization that the end has not been reached, and that the inventive genius of the future motive power experts will considerably change its form and increase its durability, efficiency and economy.

When the Giffard injector supplanted the pump for forcing water into the boiler, it proved a feed-water regulating device that enabled an engineer to operate his locomotive with absolute confidence. Now these same wonderful devices are being replaced by feed-water heaters and purifiers operated by exhaust steam. Can we not expect in the near future an improvement that will purify the water before it enters the pump and thus prolong the life of flues and fireboxes?

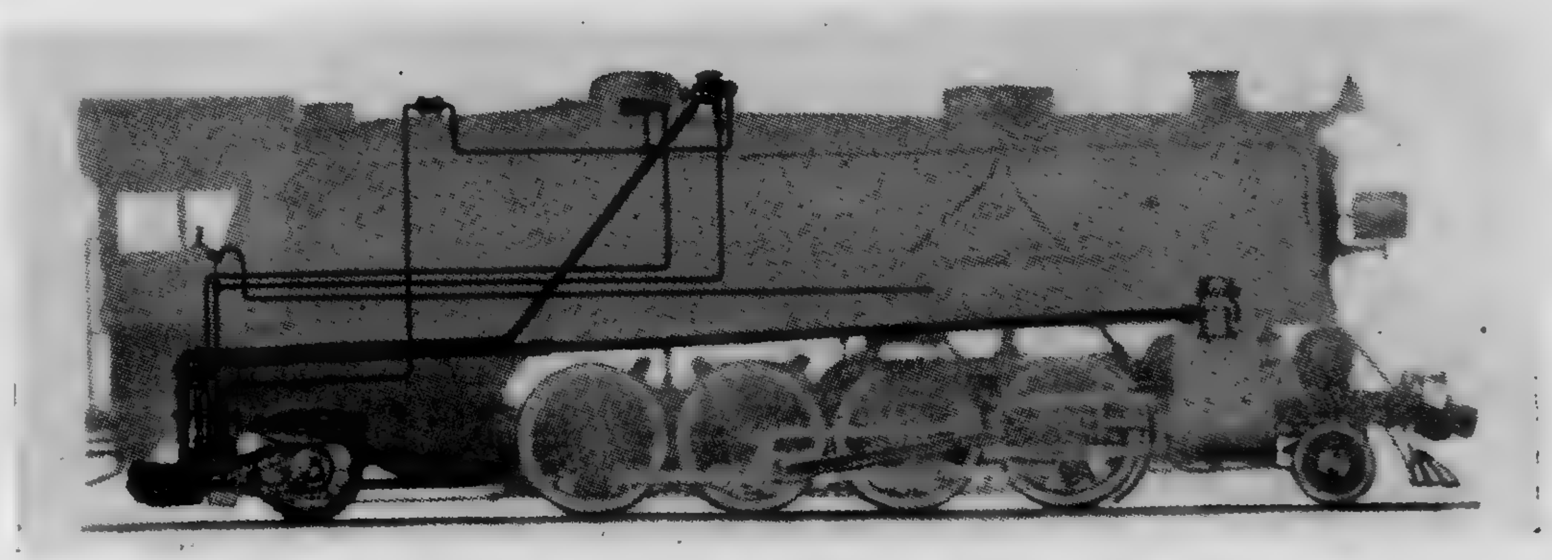


CAB VIEW OF LOCOMOTIVE EQUIPPED WITH MECHANICAL STOKER

When the size of locomotives had grown beyond the endurance power of the fireman to supply coal in proper quantity, the mechanical stoker came into play not only to relieve him of this back-breaking recreation, but also to supply the requisite amount of fuel and in a proper manner mechanically to the firebox. The superheater, the mechanical stoker, the feed-water heater and the power reverse gear are now absolute requirements on the modern high duty locomotive. The American firebrick arch in its perfected form, a perfection that has required some fifty years to accomplish is indispensable.



AMERICAN FIRE-BRICK ARCH



THE "BOOSTER" APPLIED TO A MIKADO TYPE LOCOMOTIVE

The trailing wheels under our large locomotives, some of them carrying as much as 60,000 pounds of weight, have suggested the use of what is commonly known as the "Booster." This mechanical contrivance is simply a small steam engine attached to the locomotive trailing wheels, automatically controlled so that the weight carried by the trailing wheels can be utilized for starting of heavy trains or the overcoming of short grades which govern

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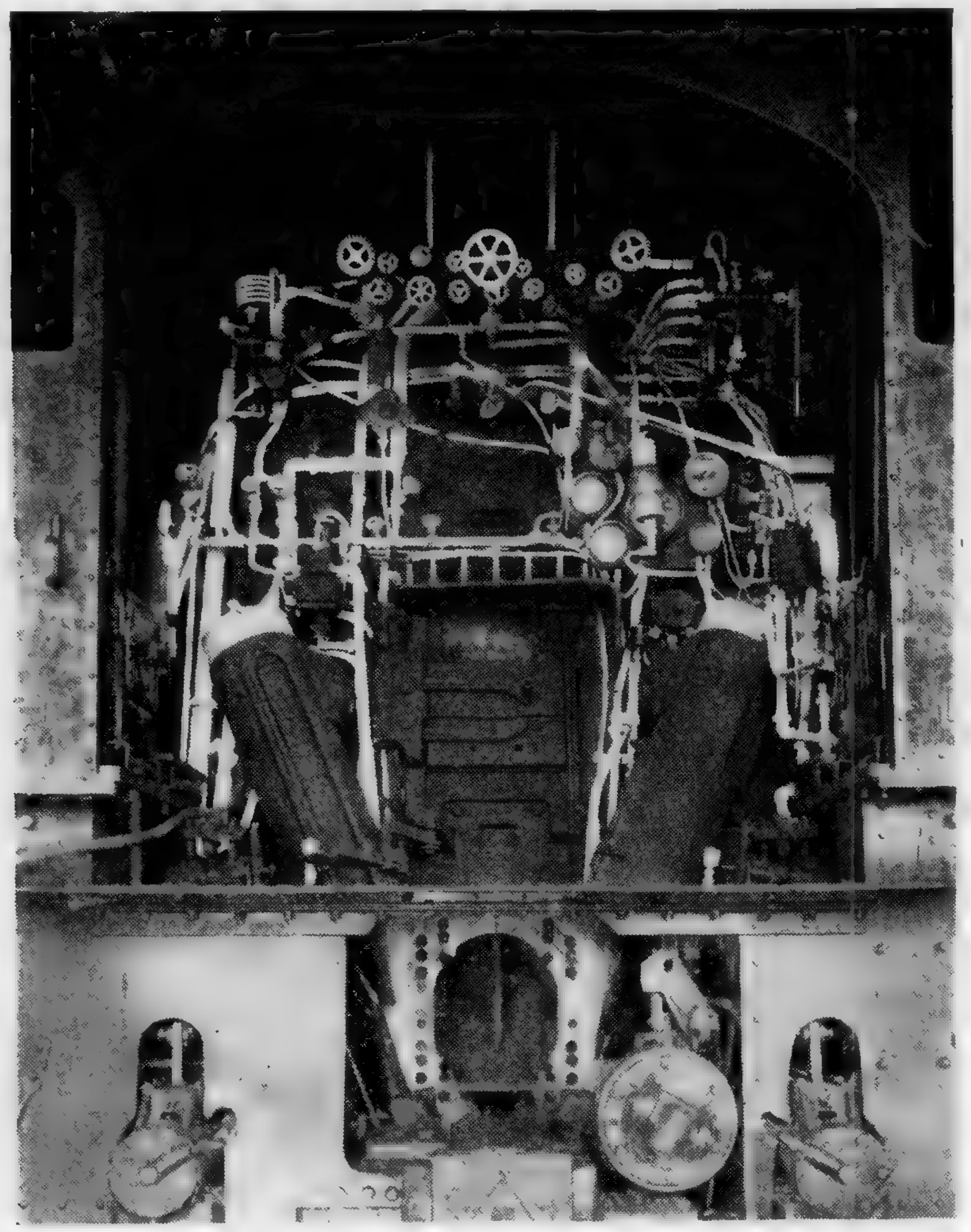

Cab View of Locomotive Equipped with Mechanical Stoker

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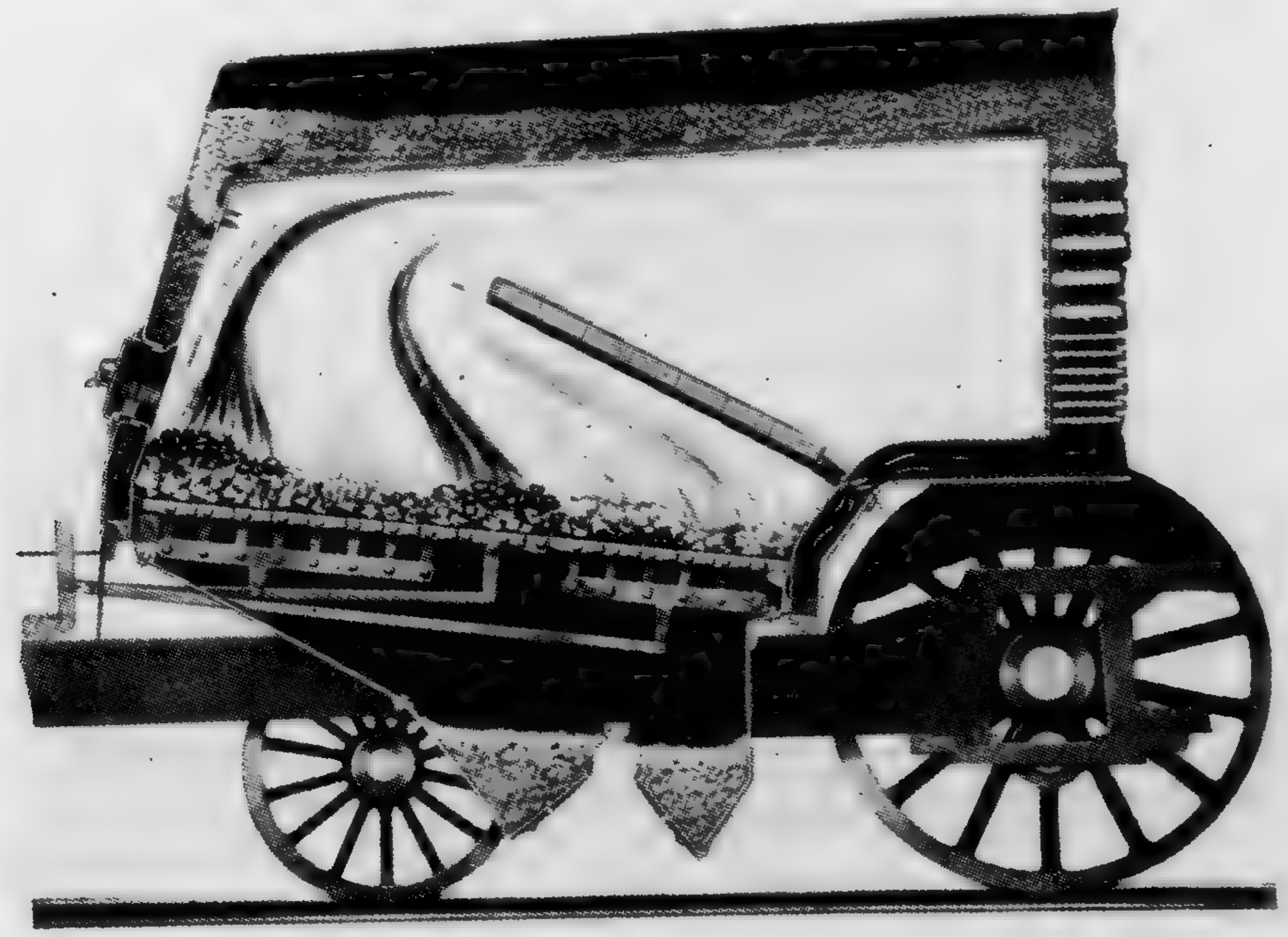
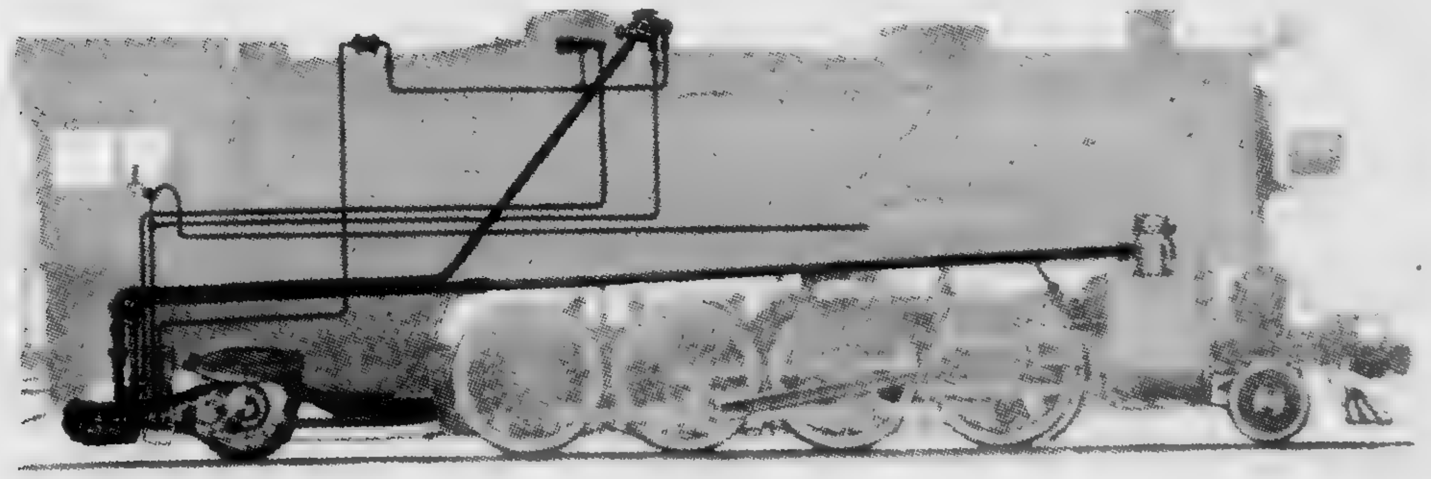


American Fire-Brick Arch



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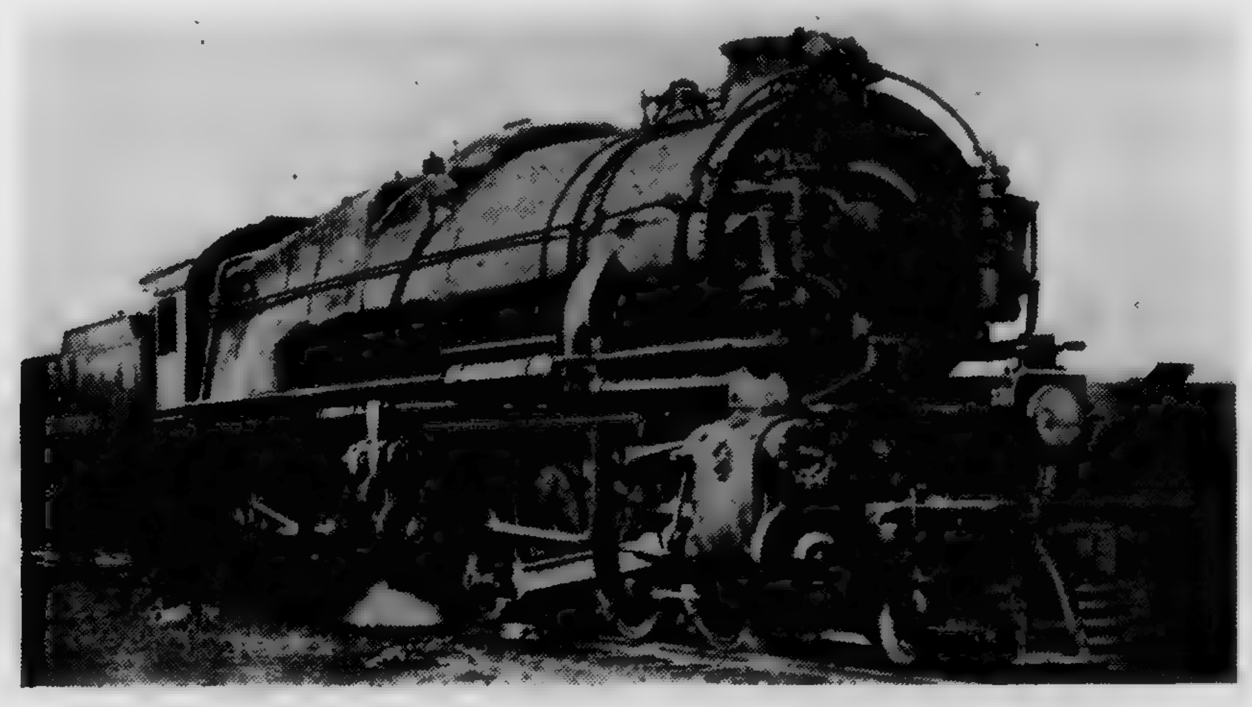
For many years the locomotive has been considered by the layman the most extravagant steam user and coal burning device in existence. This is entirely erroneous. The Pennsylvania Railroad System at the present time is having built 475 locomotives, as shown on the screen, with a tractive power of 87,000 pounds, equipped with mechanical stokers, fire brick arches, feed water heaters and superheaters of the most advanced type. The cylinders are operated at half-stroke cut-off when developing full tractive power, and the coal consumption per horse power by actual test is equal to that of some of our best electrical power houses where turbines and condensers are employed, namely an indicated horse-power-hour for 1.83 pounds of coal. Every user of locomotives should examine carefully the construction of these engines. Notwithstanding the fact that they carry 250 pounds of boiler pressure, there are many features employed worthy of general adoption. The high boiler pressure and half-stroke cut-off are also employed in a single expansion articulated locomotive, built by the Pennsylvania several years ago for heavy mountain service, which has given most satisfactory results.

Decapod Type Locomotive, Pennsylvania Railroad



Single Expansion Articulated Locomotive,
Pennsylvania Railroad

A successful effort is now being made by railway managers to increase locomotive mileage by increasing the length of runs, and on a number of roads, notably in oil-burning districts, passenger trains are being run over five, six or seven hundred mile divisions without change, except as to engine crews. One of the important factors responsible for the success of this method of operation is the use of hard grease as a lubricant, as this has eliminated much of the "oiling around" formerly required of the engineer.

It has not been my intention to omit any of the wonderful achievements attained by the designers of locomotives in the various sections of the country, or to overlook the exceedingly satisfactory and high grade productions of other locomotive establishments. My effort has been to illustrate to you all as briefly as possible the rapid advancement in locomotive construction during the past ninety years, or during the life time of The Baldwin Locomotive Works; and naturally, many of the illustrations I have shown have been selected because of my greater familiarity with them.

Locomotive development during the past 90 years has been due entirely to the constantly increasing demand of business for better and cheaper transportation. The railway systems we now enjoy have been made possible by the enterprise of our pioneer railway builders of the past, who were courageously supported financially by the public as investors. The people of the United States quickly realized the prosperity that would follow the Iron Trail. Foreign investors were quick to absorb our railway securities and the 20th Century found us far better equipped with transportation facilities than any nation in the world, as we had—

Better Service—Greater Safety—Cheaper Rates.

The requirements of a great nation had been met by the energy, the inventive genius, and splendid operating ability of those in command. This prosperity was naturally noticeable and perhaps in excess of that pertaining to other industries, in consequence of which the economist proceeded to get busy. The political aspirants to fame seized upon the opportunity offered for establishing some very serious opinions among our business friends. The regulation of transportation, as to quality of service, methods of accounting and regulation of rates were soon paramount considerations and indulged in not only by our National Legislators, but by State Governments as well. The transportation horse was well curried but poorly fed, and soon its bones were more in evidence than before so called scientific management and regulation had been introduced.

What was intended for regulation in many instances proved to be strangulation, but by superhuman effort our great transportation lines were maintained equal to our business requirements. Terminal facilities had been perfected, the right of way made staunch and secure, by using new bridges, heavier rails and all other underlying requirements for the operation of maximum cars and locomotives, both passenger and freight. The steel passenger car and the steel freight car were absolutely necessary to provide the safety desired by the public, which in turn made it imperative to produce the present modern high duty power houses or locomotives now being made, without which, railway operation today would be impossible, and the general business of our country be reduced to but a fraction of what we now enjoy. We will omit the General Wreckage caused by recent government control.

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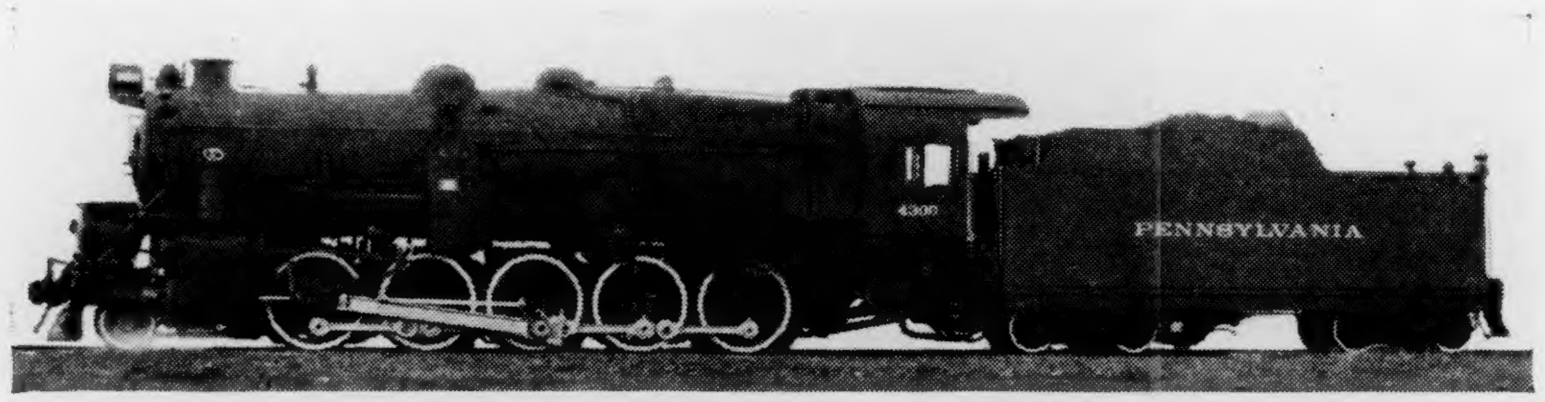

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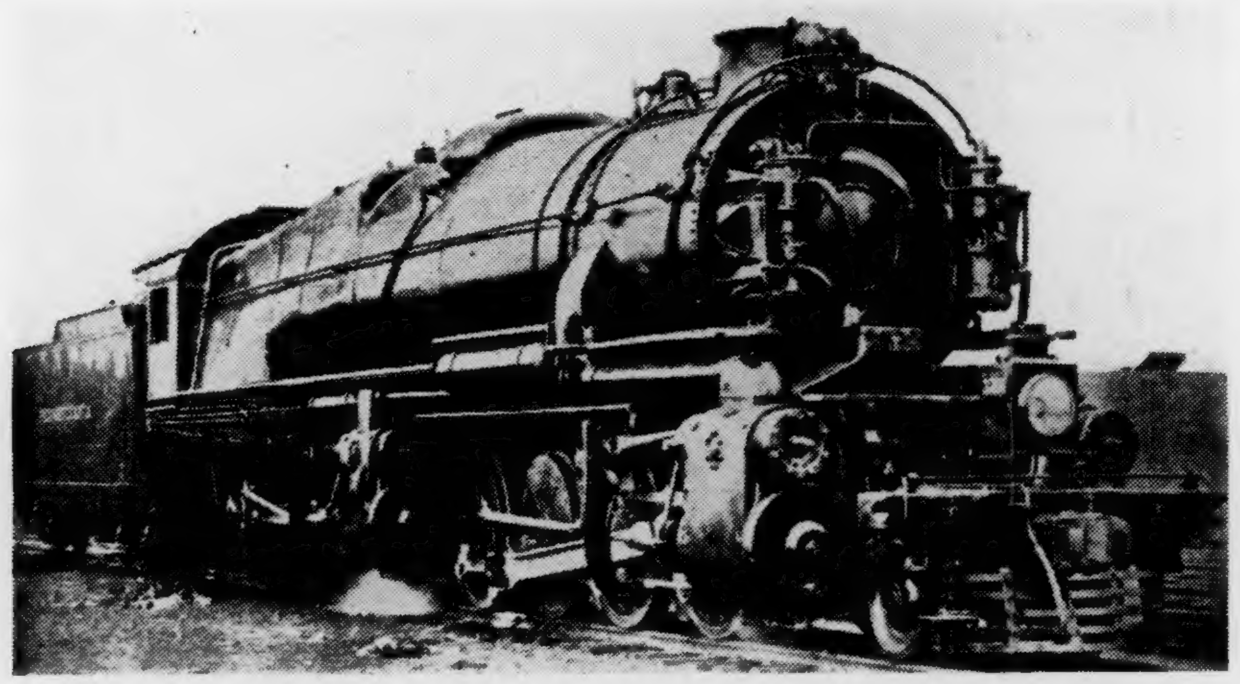

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The large expenditure of $1,540,000,000 this year by the Railway Systems of this country to pertect and provide their facilities to enable the general business of the country to proceed without interruption, is well known by all. A further reflection shows that an annual increase of 7 per cent in our requirements, will during the next ten years require at least a 7 per cent increase in railway construction and equipment in order to keep abreast of the demands of an exacting public. In other words, an expenditure of approximately $1,500,000,000 must be made annually during the next decade if we are to have dependable and proper service.

Over four thousand new locomotives will be placed in service by our railways this year, capable of developing in the aggregate over 10,000,000 horse-power.

The time has now arrived when public opinion regarding the railway transportation systems of this country and the operating devices employed thereon must be put straight. There should be a campaign for the dissemination of information and facts concerning terminal facilities, extension of lines, and reduction of delays, also as to the improved mechanical appliances, that are vitally necessary to safety and service, not alone applicable to locomotives but also to other equipment, and the facilities that must be employed to maintain and keep in proper repair the modern high duty rolling stock in service, so that once more the general public will have confidence in the various railway organizations and will point to their accomplishments with a great degree of pride. It is conceded by the entire world that in this country we have the highest perfection in railway transportation, but the general business of the country cannot progress faster than its transportation facilities will permit. The productiveness of our farms and workshops will go for naught if we do not have more efficient and more rapid facilities for the distribution of our products. The fundamental of prosperity is work, and work means that the producers of transportation are public servants whose business it is to serve the farmer and the producer, and those who are engaged in serving the transportation companies with all their numerous requirements, from steel spikes to locomotives, cannot expect increasing business unless transportation facilities are at least equal to or in advance of transportation requirements.

The way to increase prosperity is to increase our general business, and to promote our transportation facilities and various public utilities by confidence and financial support, coupled with the creation of more efficient and economical devices in transportation equipment. We must all do as your speaker has done, go out into the highways and byways of business, and speak to our business friends, encourage them to address their associates and workmen as to the necessity of abandoning the demagogue, political or otherwise, and to create among the general public a return of confidence in the vast army of Transportation Managers now responsible for the future of our country, and——

To become stockholders in all public utilities that contribute to our greatness, and especially the American Railway.

I thank you.

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TITLE